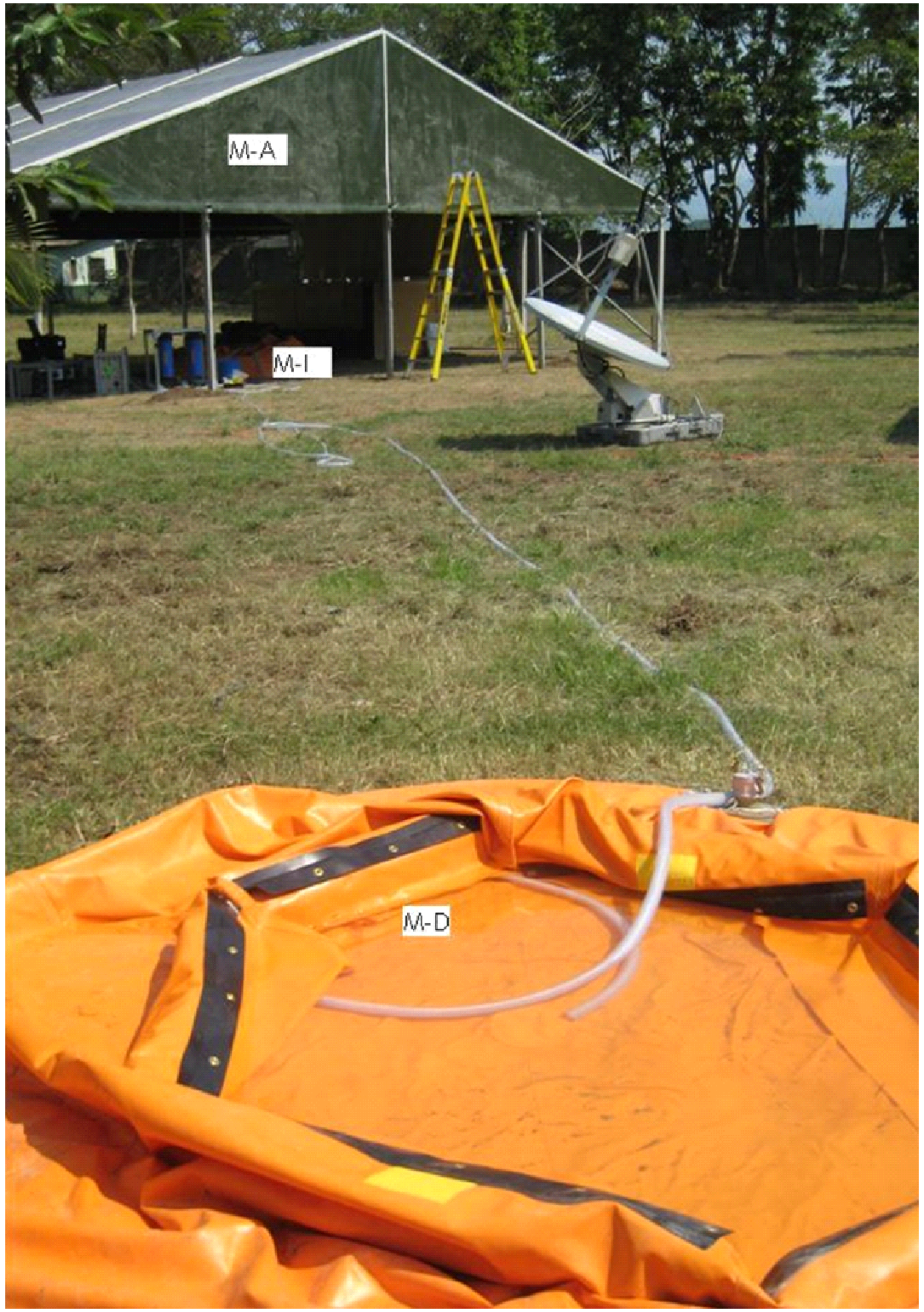

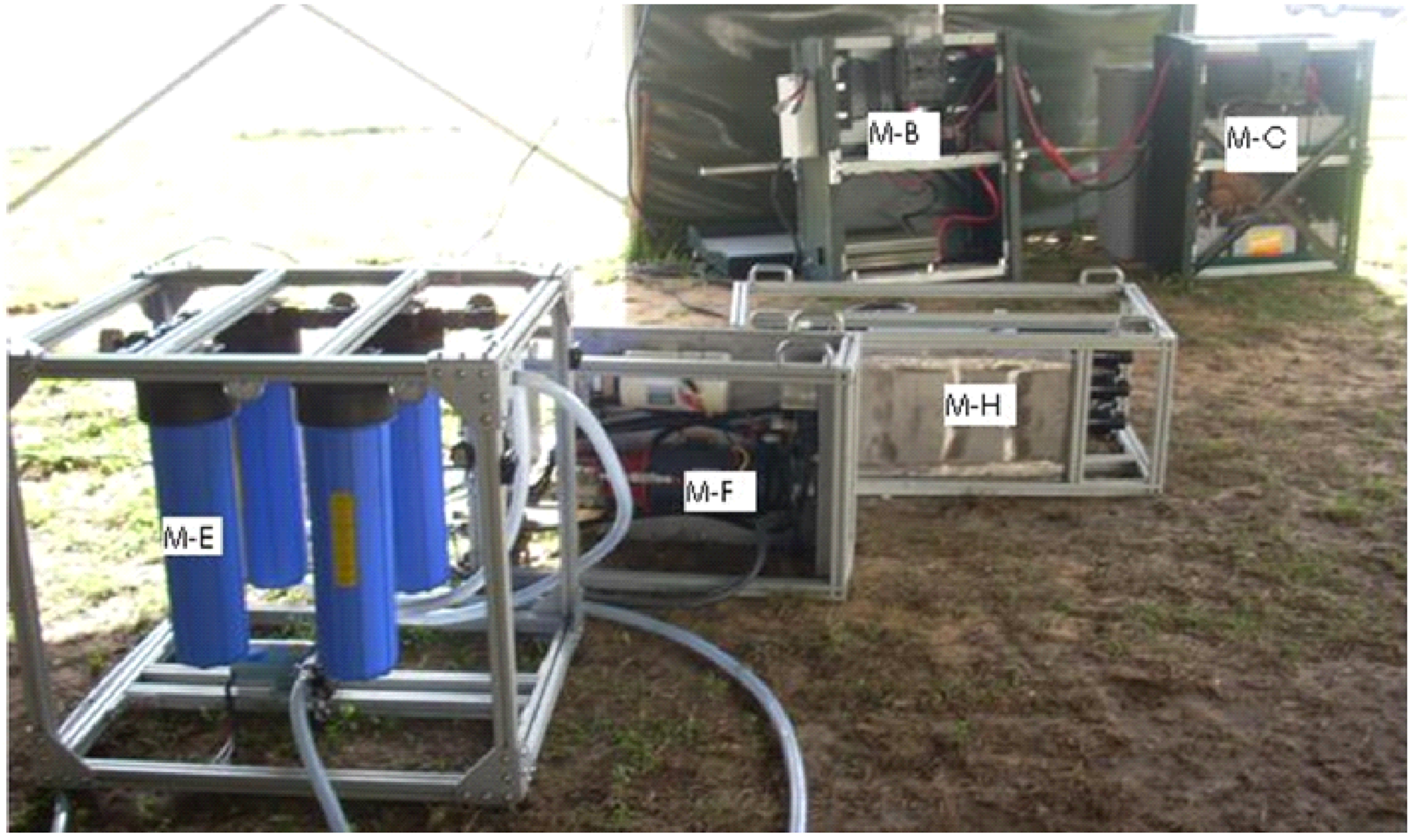

ITEM NO.	QTY.	DESCRIPTION
M-A	2	6.8 kW PV ARRAY TENT
M-B	1	POWER MODULE
M-C	1	BATTERY MODULE
M-D	1	RAW WATER STORAGE TANK
M-E	1	PREFILTRATION MODULE
M-F	1	HIGH PRESSURE PUMP MODULE
M-H	1	REVERSE OSMOSIS MODULE
M-I	1	PRODUCT WATER STORAGE TANK

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FLORIDA INTERNATIONAL UNIVERSITY

COMMENTS:
DIMENSIONS ARE IN INCHES

MORE DETAILED COMPONENT INFORMATION IS AVAILABLE IN THE APPENDICES

TITLE:
OVERALL

PROPRIETARY AND CONFIDENTIAL
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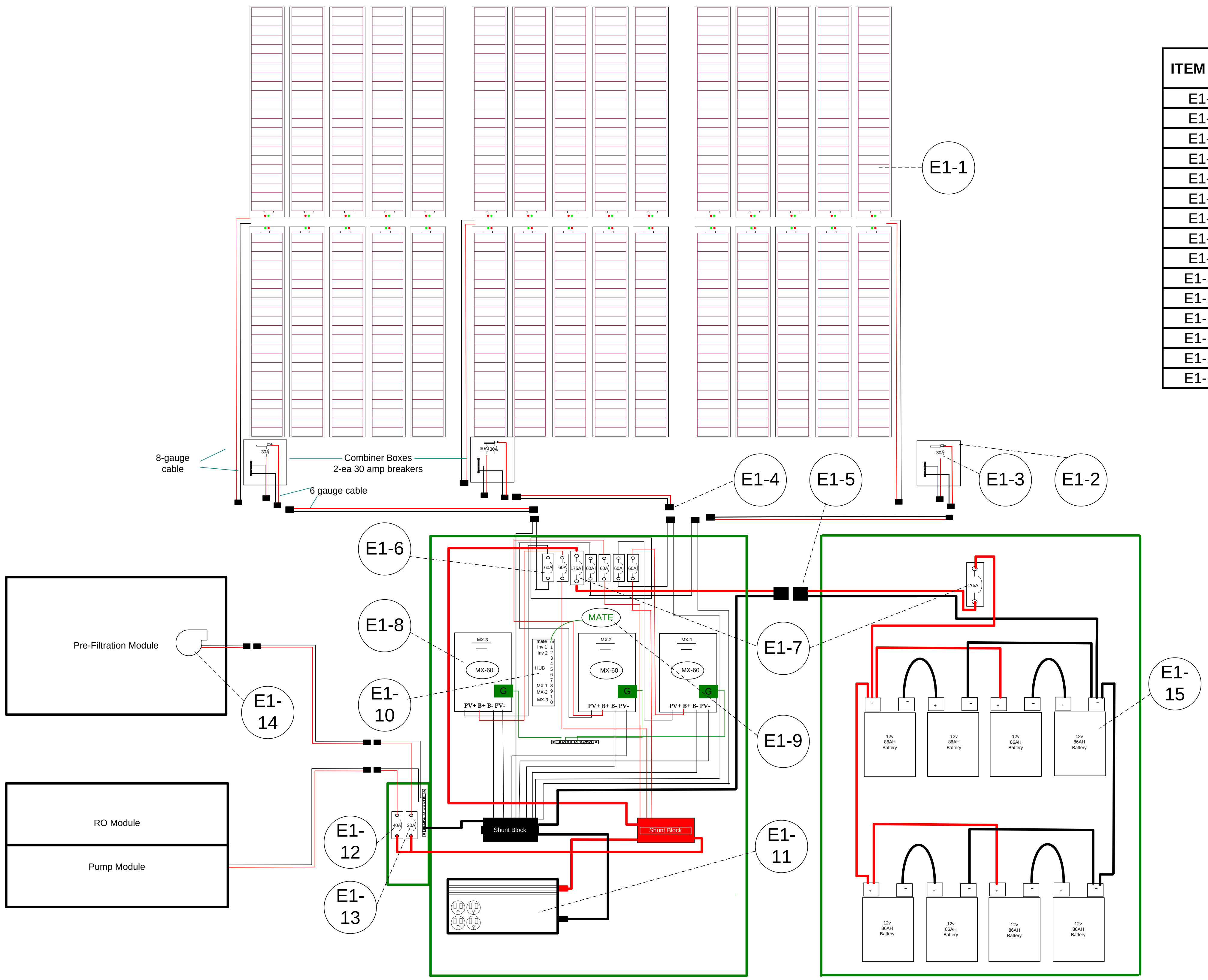
SIZE **B**
DWG. NO.
REV
SCALE: NTS
SHEET 1 OF 1

E-1

Detailed electrical schematic of the power module. Includes a table listing every component, their description, model number and quantity.

ITEM NO.	DESCRIPTION	MODEL NO.	QUANTITY
E1-1	Solar Panels	PV-136	30
E1-2	Combiner Box	FWPV-8	3
E1-3	DC 30A Breaker	OBB-30-277VAC-DIN	3
E1-4	Quick Disconect Small	SB50	24
E1-5	Quick Disconect Large	SB350	2
E1-6	DC 60A Breaker	OBB-60-150VDC120VAC-PNL	6
E1-7	DC 175A Breaker	OBB-175-125VDC-PNL	2
E1-8	Outback Charge Controler	MX60	3
E1-9	Outback Mate Computer	MATE	1
E1-10	Outback Communication Hub	HUB-10	1
E1-11	PowerBright Inverter	ML3500-24	1
E1-12	DC 40A Breaker	OBB-40-277VAC-DIN	1
E1-13	DC 20A Breaker	OBB-20-277VAC-DIN	2
E1-14	Jabsco DC Pump	23920-9313	1
E1-15	Batteries	MK 8G27	8


E1-1
8-gauge cable
Combiner Boxes
2-ea 30 amp breakers
6 gauge cable
30A
30A 30A
E1-4
E1-5
E1-3
E1-2
E1-6
E1-8
E1-10
E1-7
E1-9
E1-11
E1-12
E1-13
E1-14
E1-15
60A
175A
MATE
MX-3
MX-2
MX-1
MX-60
G
PV+ B+ B- PV-
mate
Inv 1
Inv 2
HUB
MX-1
MX-2
MX-3
Pre-Filtration Module
RO Module
Pump Module
40A
20A
Shunt Block
Shunt Block
12v 86AH Battery

COMMENTS:

TITLE:

Spectra Electrical

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SIZE	DWG. NO.	REV
B	E1	

SCALE: 1:10 WEIGHT: SHEET 1 OF 1

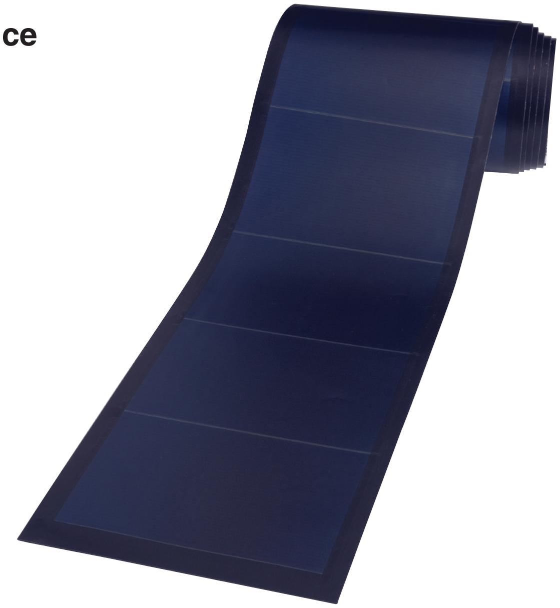
UNI-SOLAR®

Solar Laminate PVL-Series

Model: PVL-136

Data Sheet

- **High Temperature and Low Light Performance**
- **20 Year Warranty on Power Output at 80%**
- **Quick-Connect Terminals***
- **Bypass Diodes for Shadow Tolerance**
- **UL Listed to 600 VDC** Ⓤⓛ
- **Meets IEC 61646 Requirements**



PERFORMANCE CHARACTERISTICS

Rated Power (Pmax): 136W
Production Tolerance: ± 5%

CONSTRUCTION CHARACTERISTICS

Dimensions: Length: 5486mm (216”), Width: 394mm (15.5”), Depth: 4mm (0.2”), 16mm (0.6”) including junction box.
Weight: 7.7 kg (17.0 lbs.).
Output Cables: ~2.5mm^2 cable with weatherproof DC rated quick-connect terminals* 560mm (22”) length.
By-pass Diodes: Connected across every solar cell.
Laminate Encapsulation: Durable ETFE (e.g. Tefzel®) high light-transmissive polymer.
Adhesive: Ethylene propylene copolymer adhesive-sealant with microbial inhibitor.
Cell Type: 22 triple junction amorphous silicon solar cells 356 x 239mm (14” x 9.4”) connected in series.

QUALIFICATIONS AND SAFETY

Ⓤⓛ Listed by Underwriter’s Laboratories for electrical and fire safety (Class A Max. Slope 2/12, Class B Max. Slope 3/12, and Class C Unlimited Slope fire ratings) for use in systems up to 600 VDC.

LAMINATE STANDARD CONFIGURATION

Photovoltaic laminate with potted terminal housing assembly with output cables and quick connect terminals*.

OPTIONAL CONFIGURATION

Photovoltaic laminate with junction box.

*e.g., Multi-Contact (MC®) connectors.

APPLICATION CRITERION

- New or other qualified roof installations
- 16” minimum steel pan width
- PVDF Coated (Galvalume® or Zincalume® steel metal pan)
- Steel pans with flat surface (without pencil beads, stiffening ribs, or decorative stippling)
- Installation by certified installers only
- Installation temperature between 10°C - 40°C (50°F - 100°F)
- Maximum roof temperature 85°C (185°F)
- Refer to manufacturer’s installation guide for approved substrates & installation methods

FLEXIBLE

LIGHTWEIGHT

NO-GLASS

DURABLE

SHADOW TOLERANT

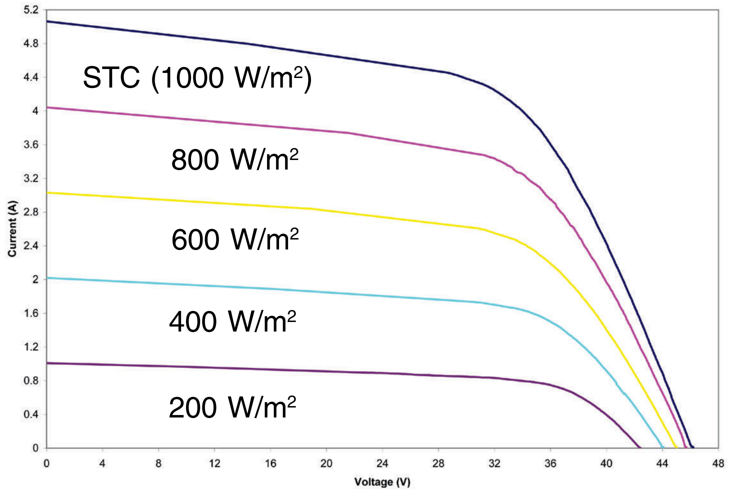
HIGH TEMP PERFORMANCE

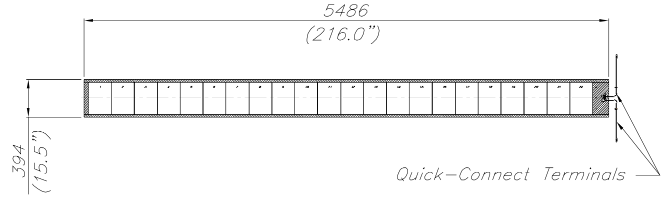
UNI-SOLAR®

Solar Laminate PVL-Series Model: PVL-136

UNI-SOLAR®

IV Curves at various levels of irradiance at Air Mass 1.5 and 25° C Cell Temperature





PVL-136

All measurements in mm.
Inches in parentheses.
Tolerances Length: ± 5mm (1/4")
Width: ± 3mm (1/8")

ELECTRICAL SPECIFICATIONS: STC

(1000 W/m², AM 1.5, 25° C Cell Temperature)

Maximum Power (Pmax): 136 W
Voltage at Pmax (Vmp): 33.0 V
Current at Pmax (Imp): 4.1 A
Short-circuit Current (Isc): 5.1 A
Open-circuit Voltage (Voc): 46.2 V
Maximum Series Fuse Rating: 8 A

NOCT

(800 W/m², AM 1.5, 1 m/sec. wind)

Maximum Power (Pmax): 105 W
Voltage at Pmax (Vmp): 30.8 V
Current at Pmax (Imp): 3.42 A
Short-circuit Current (Isc): 4.1 A
Open-circuit Voltage (Voc): 42.2 V
NOCT: 46° C

TEMPERATURE COEFFICIENTS

(at AM 1.5, 1000 W/m² irradiance)

Temperature Coefficient of Isc: 5.1mA/K
Temperature Coefficient of Voc: -176mV/K
Temperature Coefficient of Pmax: -286mW/K
Temperature Coefficient of Imp: 4.1mA/K
Temperature Coefficient of Vmp: -102mV/K

NOTES:
1. During the first 8-10 weeks of operation, electrical output exceeds specified ratings. Power output may be higher by 15%, operating voltage may be higher by 11% and operating current may be higher by 4%.
2. Electrical specifications are based on measurements performed at standard test conditions of 1000 W/m2 irradiance, Air Mass 1.5, and Cell Temperature of 25°C after stabilization.
3. Actual performance may vary up to 10% from rated power due to low temperature operation, spectral and other related effects. Maximum system open-circuit voltage not to exceed 600 VDC per UL.
4. Specifications subject to change without notice.

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UNI-SOLAR®
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FLEXware™ PV

Advanced Photovoltaic Combiner

OutBack Power Systems™

FLEX ware
FLEX ware

INTERTEK C ETL US LISTED

The OutBack Power Systems FLEXware PV combiner series sets the new standard for PV balance-of-system hardware. Ideal for both small or large systems, the FLEXware PV8 and FLEXware PV12 accommodates the overcurrent protection requirements of your application. From 150VDC breakers for low voltage PV systems, to 600VDC fuse holders for high voltage PV systems, the FLEXware PV Combiner series handles it all.

Designed to survive in outdoor environments, the rainproof, UL type 3R powder coated aluminum chassis can be mounted on a wall, sloped roof or pole. The unique angled negative terminal bus bar design makes wiring fast and easy without the larger output conductors blocking access to the smaller input terminals. Dual output lug terminals are included for up to 2/0 AWG conductors. The tinted flame-retardant polycarbonate deadfront panel creates a clean appearance while preventing accidental contact with the live terminals and is easily removable during installation.

The FLEXware PV Combiner makes it easy to take your installation to the next level.

Outdoor Rain-Resistant Aluminum Enclosure

Optimized Wire Routing For Easy Installation

Tinted Flame-Retardant Polycarbonate Deadfront Panel

Generous Wiring / Conduit Knockouts

Wall, Roof or Pole Mountable

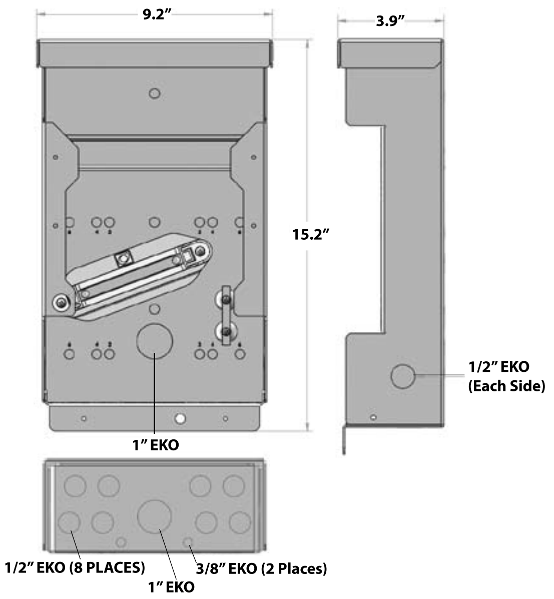
Accommodates dual 2/0 AWG output wiring

Accommodates 150VDC DC Breakers or 600 VDC Fuses

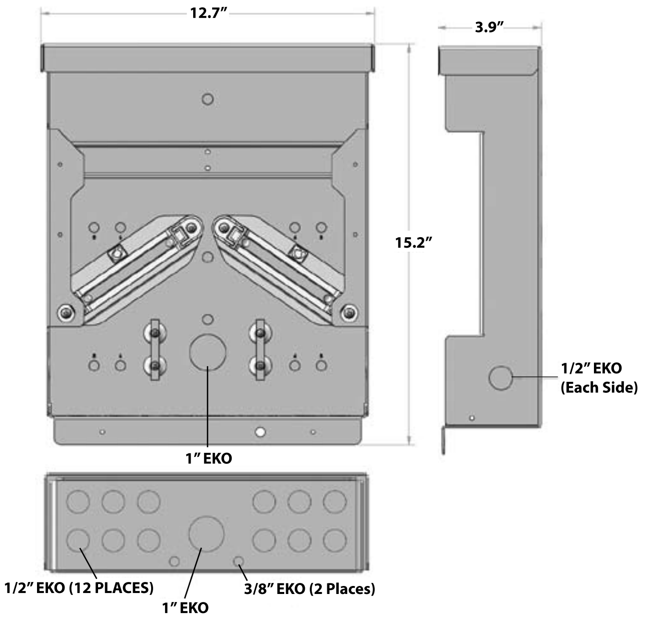
FLEXware™ PV Specifications

	FWPV-8	FWPV-12
Enclosure Material	Powder coated aluminum with stainless steel hardware	Powder coated aluminum with stainless steel hardware
Mounting Options	Vertical wall mount, pole mount or sloped roof mount to 14 degrees incline (3 in 12 roof pitch)	Vertical wall mount, pole mount or sloped roof mount to 14 degrees incline (3 in 12 roof pitch)
Enclosure Rating	Outdoor Rainproof, UL Type 3R	Outdoor Rainproof, UL Type 3R
Enclosure Security	Padlock hole in chassis and cover for up to 3/8 inch pad lock	Padlock hole in chassis and cover for up to 3/8 inch pad lock
Output Terminals	#14 - 2/0 AWG (2.08 - 67.43 mm^2) Two box lug terminals included	#14 - 2/0 AWG (2.08 - 67.43 mm^2) Four box lug terminals included
Number of separate circuits	One Circuit	One or Two Circuits
Number of 150VDC breakers	up to 8	up to 12 (two groups of six)
Number of 600VDC fuse holders	up to 6	up to 8 (two groups of four)
Input Terminal	150VDC Breakers / #14 - 6 AWG (2.08 - 13.3 mm^2) 600VDC Fuse / #14 - 10 AWG (2.08 - 5.26 mm^2)	150VDC Breakers / #14 - 6 AWG (2.08 - 13.3 mm^2) 600VDC Fuse / #14 - 10 AWG (2.08 - 5.26 mm^2)
Dimensions		
Unit (H x W x D)	15.2 x 9.2 x 3.9" (38.7 x 23.3 x 9.9 cm)	15.2 x 12.7 x 3.9" (38.7 x 32.2 x 9.9 cm)
Shipping (H x W x L)	4.3 x 9.5 x 19" (10.9 x 24.1 x 48.3 cm)	4.3 x 13 x 19" (10.9 x 33 x 48.3 cm)
Weight		
Unit	4.4 lbs (2.0 kg)	5.9 lbs (2.7 kg)
Shipping	5.5 lbs (2.5 kg)	7.4 lbs (3.3 kg)

FLEXware™ PV8



FLEXware™ PV12



OutBack Power Systems™

Available From:

Main Office:
19009 62nd Avenue NE
Arlington, WA 98223 USA
Phone: (360) 435.6030
Fax: (360) 435.6019

European Office:
C/ Castelló, 17
08830 - Sant Boi de Llobregat
BARCELONA, España
Phone: +34.93.654.9568

www.outbackpower.com

30 Amp 277 VAC 50/60 HZ single pole 0.5” (13 mm) wide

The only information available is the model number and the manufacturer’s website.

Model number: OBB-30-277VAC-DIN
www.outbackpower.com/products/integration_hardware/breakers/

Anderson Power Products.

SB®50
Connector

The innovative SB® connectors provide cost-effective reliability, design flexibility and safety for your products' manufacture, installation and maintenance.

APP's 2 pole connector is available with a 50 amp rating, 600 Volts continuous AC or DC operation. There are SB® connectors for many applications and wire sizes, #6 to #16 AWG (13.3 to 1.3 mm²). Mechanical keys ensure connectors will only mate with connectors of the same color. Different color housings are selected to identify voltages, thus preventing mismatching of the power supply system.

FEATURES

- **Mechanical keyed housings**
  Prevents accidental mating of components operating at different voltage levels
- **Single-piece housing and unitized construction**
  Provides industrial quality and durability
- **Genderless design**
  Makes assembly quick and easy and reduces number of parts stocked

PRODUCT SPECIFICATIONS

Connector Model	SB ®50	Connector Model	SB ®50
UL Current Rating (Amperes)*	50*	Life	
		a. No load (Contact/Disconnect Cycles)	To 10,000
UL Voltage Ratings (Volts)	600*	b. Under Load (Hot Plug 250 cycles @ 120V)	50A
Contact Barrel Wire Size (AWG) (mm²)	#6 to #16 13.3 to 1.3	Avg. Connection/Disconnect (lbf)	10 - low detent 15 - high detent
Maximum Wire Insulation Diameter (inches) (mm)	0.44 11.2	Operating Temperature Range °C** °F	-20° to 105° -4° to 221°
AVG Contact Resistance* (micro-ohms)	200	Flammability Rating of Housing Material	UL94 V-0
Insulation Withstanding Test Voltage (Volts AC/DC)	2200		
Contact Retention Force (lbf)	50		

** UL Rated for 65°C largest wire or cable size*

*** Contact factory for higher temperature rated connector*

SB®, UL and CSA Reference: This equipment is an Underwriters Laboratories Inc® recognized component. It is also listed by the Canadian Standards Association as certified.

ORDERING INFORMATION

2 Pole Housing & 50 amp Contacts

Part Number	Housing Color	Wire AWG	Wire sq. mm
6319	Gray	#6	13.3
6319G1	Gray	#10/12	5.3/3.3
6331G1	Red	#6	13.3
6331G2	Red	#10/12	5.3/3.3
6331G3	Black	#6	13.3
6331G4	Black	#10/12	5.3/3.3
6331G5	Blue	#6	13.3
6331G6	Blue	#10/12	5.3/3.3
6331G7	Yellow	#6	13.3
6331G8	Yellow	#10/12	5.3/3.3
6331G9	Green	#6	13.3
6331G10	Green	#10/12	5.3/3.3
6331G11	Orange	#6	13.3
6331G12	Orange	#10/12	5.3/3.3

** LD - low detent or HD - high detent*

Note: For additional colors please contact customer service

Housings Only

Part Number	Description
992	Gray
992G1	Red
992G2	Black
992G4	Blue
992G5	Yellow
992G6	Green
992G7	Orange

50 amp Contacts*

Part Number	Description	Wire AWG	Wire sq. mm
903G1	Contact set (2) 5900	#6	13.3
904G1	Contact set (2) 5915	#10/12	5.3/3.3
5900	Individual - HD	#6	13.3
1307	Individual - LD	#6	13.3
5952	Individual - HD	#8	8.4
5953	Individual - LD	#10/12	5.3/3.3
5914	Individual - HD	#10	5.26
5915	Individual - HD	#10/12	5.3/3.3

50 amp contacts continued

Part Number	Description	Wire AWG	Wire sq. mm
265G1	Reel, silver - HD	#6/8	13.3/8.4
265G2	Reel, silver - HD	#10/12	5.3/3.3
265G3	Reel, silver - LD	#6/8	13.3/8.4
265G4	Reel, silver - LD	#10/12	5.3/3.3
265G5	Reel, tin - HD	#6/8	13.3/8.4
265G6	Reel, tin - HD	#10/12	5.3/3.3
265G7	Reel, tin - LD	#6/8	13.3/8.4
265G8	Reel, tin - LD	#10/12	5.3/3.3
75BBS	Bus bar contact	N/A	N/A

Accessories

Part Number	Description
SB50-HDL-Red	Handle & hardware, red
134G1	Dust cover, red
990	Cable clamp & hardware, self attaching, 2C
990G2	Cable clamp, 2 single conductors

HEADQUARTERS: 13 Pratts Junction Road, Sterling, MA 01564-2305 USA T:978-422-3600 F:978-422-3700
EUROPE: Rathealy Road, Fermoy Co. Cork, Ireland T:353-(0)25-32277 F:353-(0)25-32296
ASIA/PACIFIC: IDEAL Anderson Asia Pacific Ltd., Unit 922-928 Topsail Plaza, 11 On Sum Street, Shatin N.T., Hong Kong T:852-2636-0836 F:852-2635-9036
CHINA: IDEAL Anderson Technologies (Shenzhen) Ltd., Block A8 Tantou W. Ind. Par, Songgang Baoan District, Shenzhen, PR. China 51810 T: 86-755-2768-2118 F: 86-755-2768-2218
TAIWAN: IDEAL Anderson Asia Pacific Ltd., Taiwan Branch, 4F.-2, No.116, Dadun 20th St., Situn District, Taichung City 407, Taiwan (R.O.C.) T: 886-4-2310-6451 F:886-4-2310-6460
www.andersonpower.com

SB®50 Connector

ORDERING INFORMATION

accessories continued

Part Number	Description
990G1	Cable clamp & hardware-screw mounting-2C
5905	Cable clamp-1 twin conductor with hardware
110G57	Lock nut for use with bus bar contact

Bushings

Part Number	Description	Reduces From AWG	sq. mm
5910	Use with 5900 or 1307	#6 to #10/12	13.3 to 5.3/3.3
5912	Use with 5900 or 1307	#6 to #8	13.3 to 8.4
5913	Use with 5900 or 1307	#6 to #14/16	13.3 to 2.1/1.3

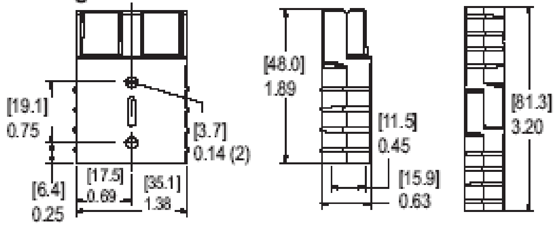
Tooling

Part Number	Description
1309G4	Hand tool
1387G1	Pneumatic tool
1388G6	- die for #6 to #16 AWG
1388G7	- die for #10 to #12 AWG
1389G6	- locator for #6 to #16 AWG
1389G7	- locator for #10 to #12 AWG
260G16	Applicator only (110V & 220V)
*	Applicator & Press (220V, 50Hz)
*	Press only (110V, 60Hz)

** Consult factory*

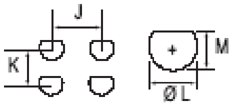
DIMENSIONS

Housing



Bus Bar Layout

Part Number	- J - mm	in.	- K - mm	in.	- L - mm	in.	- M - mm	in.
75BBS	19.1	0.75	17.3(min)	0.68(min)	6.73	0.265	2.92	0.115

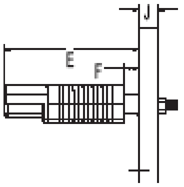


Mounting Dimensions

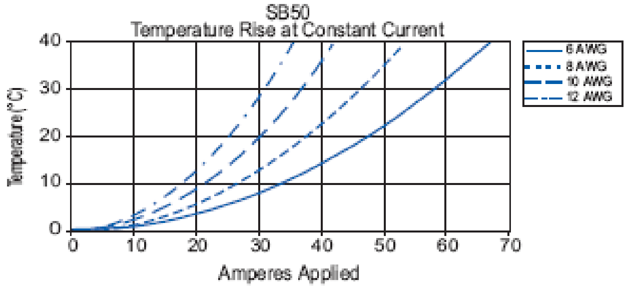
Bus Bar Mounting Table

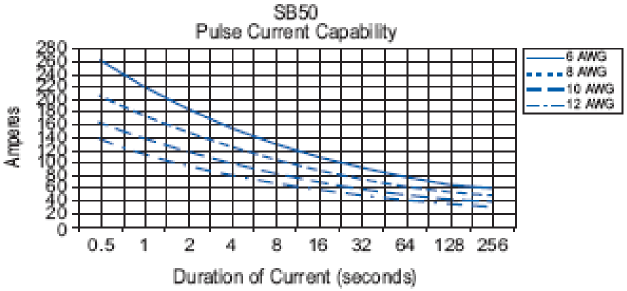
Part Number	-E- mm	in.	-F- mm	in.
75BBS	53.3	2.10	5.10	0.20

Part Number	-J- mm	in.
75BBS	3.0 - 12.7	0.12 - 0.50



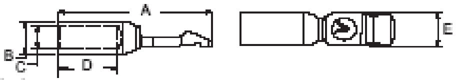
TEMPERATURE RISE CHARTS



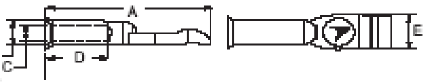


Contacts

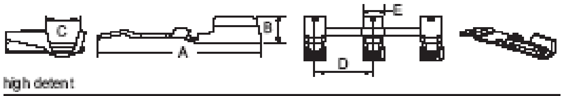
Part Number	-A- mm	in.	-B- mm	in.	-C- mm	in.	-D- mm	in	-E- mm	in.
1307	30.0	1.18	7.2	0.28	5.6	0.22	11.4	0.45	7.1	0.28
5900	30.0	1.18	7.2	0.28	5.6	0.22	11.4	0.45	7.1	0.28
5914	29.7	1.17	4.8	0.19	3.5	0.14	11.4	0.45	7.1	0.28
5915	30.0	1.18	7.2	0.28	3.5	0.14	11.4	0.45	7.1	0.28
5952	30.0	1.18	7.2	0.28	4.7	0.19	11.4	0.45	7.1	0.28
5953	30.0	1.18	7.2	0.28	3.5	0.14	11.4	0.45	7.1	0.28
904G1	30.0	1.18	7.2	0.28	3.5	0.14	11.4	0.45	7.1	0.28
903G1	30.0	1.18	7.2	0.28	5.6	0.22	11.4	0.45	7.1	0.28
265G1	31.8	1.25	9.1	0.36	9.1	0.36	22.9	0.90	8.1	0.32
265G2	31.8	1.25	7.4	0.29	6.9	0.27	22.9	0.90	8.1	0.32
265G3	31.0	1.22	9.1	0.36	9.1	0.36	22.9	0.90	8.1	0.32
265G4	31.0	1.22	7.4	0.29	6.9	0.27	22.9	0.90	8.1	0.32
265G5	31.8	1.25	9.1	0.36	9.1	0.36	22.9	0.90	8.1	0.32
265G6	31.8	1.25	7.4	0.29	6.9	0.27	22.9	0.90	8.1	0.32
265G7	31.0	1.22	9.1	0.36	9.1	0.36	22.9	0.90	8.1	0.32
265G8	31.0	1.22	7.4	0.29	6.9	0.27	22.9	0.90	8.1	0.32
75BBS	See Bus Bar Section									



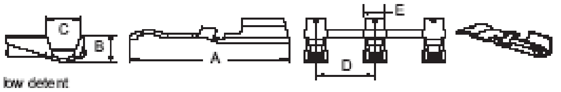
Individual - high detent



Individual - low detent



Reeled - high detent



Reeled - low detent

CSA Certified File No. LR25154   c US File No. E26226   *All Data Subject To Change Without Notice*

SB® 350
Connector

The innovative SB® connectors provide cost-effective reliability, design flexibility and safety for your products' manufacture, installation and maintenance.

APP's 2 pole connector is available with a 350 amp rating, 600 Volts continuous AC or DC operation. There are SB® connectors for many applications and wire sizes, 2/0 AWG to 300 mcm (67.4 to 152.0 mm²). Mechanical keys ensure connectors will only mate with connectors of the same color. Different color housings are selected to identify voltages, thus preventing mismatching of the power supply system.

FEATURES

- **Mechanical keyed housings**
  Prevents accidental mating of components operating at different voltage levels
- **Single-piece housing and unitized construction**
  Provides industrial quality and durability
- **Genderless design**
  Makes assembly quick and easy and reduces number of parts stocked

PRODUCT SPECIFICATIONS

Connector Model	SB ®350
UL Current Rating (Amperes)*	350*
UL Voltage Ratings (Volts)	600*
Contact Barrel Wire Size (AWG)	2/0 to 300 mcm
(mm²)	67.4 to 152.0
Maximum Wire Insulation Diameter (inches)	1.10
(mm)	27.9
AVG Contact Resistance* (micro-ohms)	50
Insulation Withstanding Test Voltage (Volts AC/DC)	2200
Contact Retention Force (lbf)	500

Connector Model	SB ®350
Life	
a. No load (Contact/Disconnect Cycles)	To 10,000
b. Under Load (Hot Plug 250 cycles @ 120V)	100A
Avg. Connection/Disconnect (lbf)	30
Operating Temperature Range °C**	-20° to 105°
°F	-4° to 221°
Flammability Rating of Housing Material	UL94 V-0

** UL Rated for 65°C largest wire or cable size*
*** Contact factory for higher temperature rated connector*
SB®, UL and CSA Reference: This equipment is an Underwriters Laboratories Inc® recognized component. It is also listed by the Canadian Standards Association as certified.

ORDERING INFORMATION

2 Pole Housing & 350 amp Contacts

Part Number	Housing Color	Wire AWG	Wire sq. mm
6320G1	Gray	2/0	67.4
6320G2	Gray	4/0	107.2
6320G4	Gray	300 mcm	152.0
6320G5	Gray	3/0	85.0
6321G1	Blue	2/0	67.4
6321G2	Blue	4/0	107.2
6321G4	Blue	300 mcm	152.0
6321G5	Blue	3/0	85.0
6322G1	Red	2/0	67.4
6322G2	Red	4/0	107.2
6322G4	Red	300 mcm	152.0
6322G5	Red	3/0	85.0
6323G1	Yellow	2/0	67.4
6323G2	Yellow	4/0	107.2
6323G4	Yellow	300 mcm	152.0
6323G5	Yellow	3/0	85.0

2 Pole Housing & 350 amp Contacts continued

Part Number	Description	Wire AWG	Wire sq. mm
6324G1	Green	2/0	67.4
6324G2	Green	4/0	107.2
6324G4	Green	300 mcm	152.0
6324G5	Green	3/0	85.0
6400G1	Orange	2/0	67.4
6400G2	Orange	4/0	107.2
6400G4	Orange	300 mcm	152.0
6400G5	Orange	3/0	85.0

Housings Only

Part Number	Color
906	Gray
912	Blue
913	Red

housings continued

Part Number	Color
914	Yellow
931	Green
932	Orange

Contacts

Part Number	Description	Wire AWG	Wire sq. mm
917	Contact set (2)	1/0	53.5
907	Contact set (2)	2/0	67.4
916	Contact set (2)	3/0	85.0
908	Contact set (2)	4/0	107.2
910	Contact set (2)	300 mcm	152.0
350BBS	Bus bar contact	N/A	N/A

Note: For additional colors please contact customer service

SB®350 Connector

ORDERING INFORMATION

Accessories

Part Number	Description
995G2	Handle & hardware-gray
995G4	Handle & hardware-red
919	Manual release-locking half-cable clamps, hardware & lock out spring for the battery
919G1	Mounting half-mounting half-hardware & lock out spring for battery
922G1	Mounting half-hardware for truck or charger
111197G1	Charger key
134G3	Dust cover
996G1	Cable clamps-2 single conductor with hardware
911	Cable clamps-2 single conductor, cables with hardware and steel handle
SB350-lockout	Safety lockout

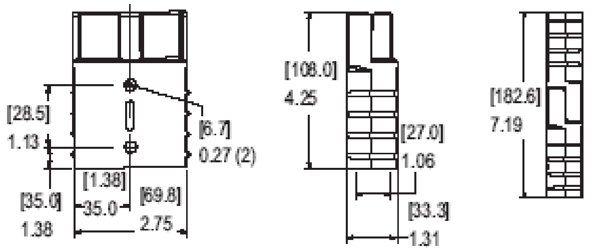
Bushings

Part Number	Description	Wire AWG	Wire sq.mm
5918	Use with 907	2/0 to 1/0	67.4 to 53.5

Tooling

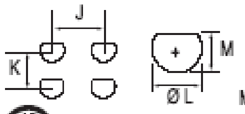
Part Number	Description
1368	Hand tool for 1/0 to 300 mcm
1387G1	Pneumatic tool
1387G2	Pneumatic tool
1388G2	- die for 2/0 to 3/0
1389G2	- locator for 2/0 to 3/0
1388G1	- die for 4/0
1389G1	- locator for 4/0
1304G9	- loctor for 4/0
1303G3	- die for 4/0

Housing



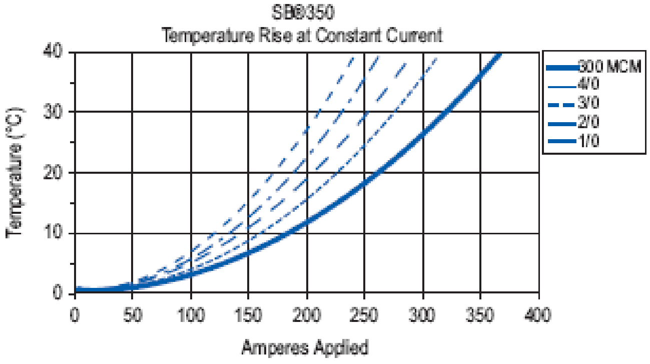
Bus Bar Layout

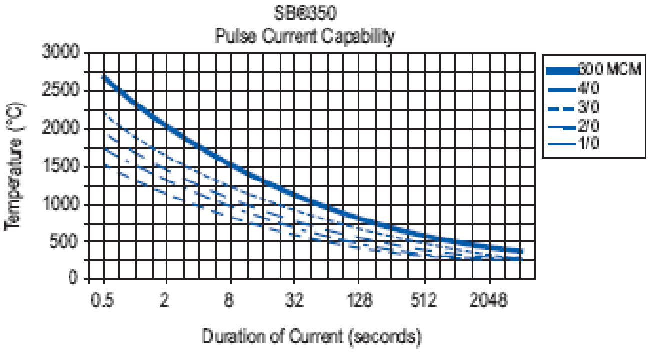
Part Number	-J- mm	-J- in.	-K- mm	-K- in.	-L- mm	-L- in.	-M- mm	-M- in.
350BBS	34.9	1.38	33.8(min)	1.33(min)	13.34	0.525	11.76	0.463



Mounting Dimensions

TEMPERATURE RISE CHART

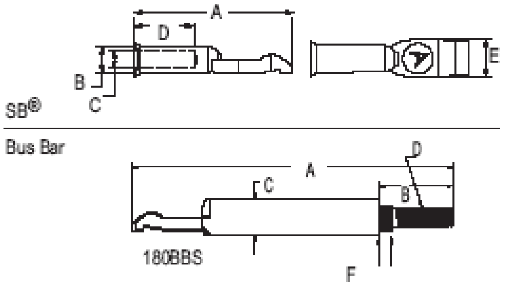




DIMENSIONS

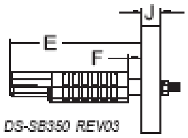
SB® Contacts

Part Number	-A- mm	-A- in.	-B- mm	-B- in.	-C- mm	-C- in.	-D- mm	-D- in	-E- mm	-E- in.
907	75.1	2.96	16.3	0.64	12.4	0.49	32.8	1.29	20.6	0.81
908	75.1	2.96	19.1	0.75	16.3	0.64	32.8	1.29	20.6	0.81
910	73.9	2.91	22.2	0.87	19.1	0.75	32.5	1.28	20.6	0.81
916	75.1	2.96	17.9	0.7	14.7	0.58	32.8	1.29	20.6	0.81
917	73.9	2.91	13	0.51	11.1	0.44	31.8	1.25	20.6	0.81
350BBS	131.7	5.19	22.3	0.88	17.0	0.67	N/A	#3/8-19Thd.	2.5	0.10



Bus Bar Mounting Table

Part Number	-E- mm	-E- in.	-F- mm	-F- in.	-J- mm	-J- in.
350BBS	113.0	4.45	5.1	0.20	3.0 -19.6	0.12 -0.77



CSA Certified
File No. LR25154
c US File No. E26226
All Data Subject To Change Without Notice

60 Amp 150 VDC and 120 VAC, 1/4" stud terminals

The only information available is the model number and the manufacturer’s website.

Model number: OBB-60-150VDC120VAC-PNL
www.outbackpower.com/products/integration_hardware/breakers/

175 Amp, 125 VDC, 3/8” stud terminals

The only information available is the model number and the manufacturer’s website.

Model number: OBB-175-125VDC-PNL
www.outbackpower.com/products/integration_hardware/breakers/

OutBack
Power Systems

MX60

PV MPPT Charge Controller

INSTALLATION AND USER'S MANUAL

Please read this entire manual prior to installing and using the MX60

OutBack Power Systems, Inc 19009 62nd Ave NE Arlington WA 98223 360-435-6030

900-0028-2 REV 5.00
Serial #s 2000 and beyond...
Copyright 2003, 2004
OutBack Power Systems

INTRODUCING THE OUTBACK MX60 PV MPPT CONTROLLER

Your OutBack PV MX60 Maximum Power Point Tracking (MPPT) charge controller enables your PV system to achieve its highest possible performance.

Rated for up to 60 amps of DC output current, your MX60 can be used with battery systems from 12 to 60 vdc with PV open circuit voltages as high as 140 Vdc. The MX60's setpoints are fully adjustable to allow use with virtually any battery type, chemistry and charging profile.

Your MX60 allows you to use a higher output voltage PV array with a lower voltage battery - such as charging a 24 vdc battery with a 48 vdc PV array. This reduces wire size and power loss from the PV array to the battery/inverter location and can maximize the performance of your PV system. This also ensures that the Maximum Power Point V from your array is always above the battery voltage when the panels are hot, which might make it harder to Equalize or keep the battery at a higher voltage when it is called for.

Your MX60 comes standard with an easy to use and understand display of the PV system's performance. The four line, 80 character, backlit LCD display is also used for programming and monitoring of the system's operation.

Your MX60 can also be connected to the OutBack MATE system controller and display to allow monitoring of up to four or ten MX60 controllers (with the optional 4 or 10 port Hub) from a distant location - up to 1000 feet away. The MATE also includes an opto-isolated RS232 port for connection to a PC computer for data logging and system monitoring.

A built-in Auxiliary Output Control System can be used to control a secondary control circuit, relay or contactor. It can be used to control a diversion load, turn off loads when a low battery condition occurs, or other functions.

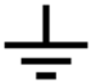
IMPORTANT SAFETY INSTRUCTIONS

A. SAVE THESE INSTRUCTIONS – This manual contains important instructions for the MX60 Charge Controller that shall be followed during installation and maintenance of the charge controller.

B. Torque the terminal block and ground terminals to 30 inch pounds / 4Nm

C. Use a minimum of 6AWG copper conductors only suitable for a minimum of 75 degrees C. The terminal block and ground terminal will accept up to 2 AWG conductors.

D. This symbol is used to identify chassis ground.



E. This charge controller is intended to charge lead acid battery systems, sealed or vented with nominal voltages of 12, 24, 32, 36, 48, 54 or 60 volts DC. For other battery chemistries, contact the battery manufacturer for specific charge control settings and methodologies.

F. The MX60 PV MPPT Charge Controller is for indoor use only.

INSTALLATION

The MX60 is designed to be mounted in a variety of ways. One of the more common methods of mounting is on an OutBack charge controller bracket (CCB), attached to an OutBack PSDC or PS2DC enclosure. Each MX60 comes with three #10 stainless steel sheet metal screws for this purpose. Under the wiring compartment cover are holes through the mounting feet for attachment to the CCB. There is also a mounting tab at the top of the MX60. When mounted to the OutBack CCB, the left side knockout will line up with knockouts in the PSDC. A standard ¾" or 1" plastic snap-in bushing will offer protection from chafing between the two boxes. Note that there are two placement options on the CCB that can be used to match with knockouts in the PSDC. Mounting holes and knockouts are compatible with C40 controllers to help set an industry standard. Two MX60 controllers may be installed on the CCB. Note the placement shown in Figure 1.

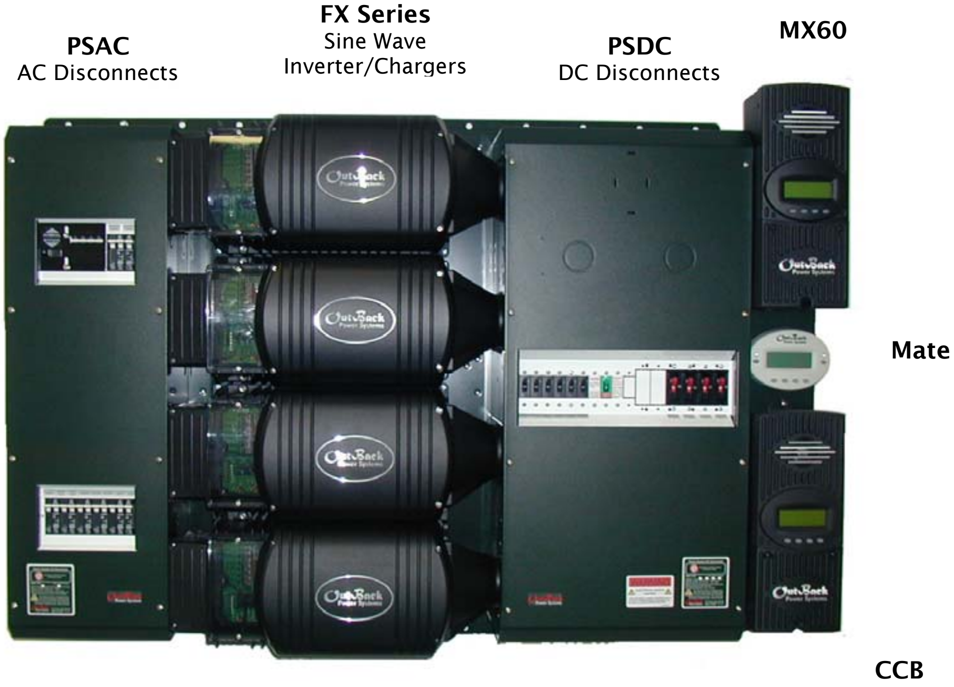


Figure 1 - Two MX60 controllers mounted on a CCB (charge controller bracket) with four OutBack FX2000 and the PSDC, PSAC enclosures

MOUNTING THE MX60

Up to three MX60's can also be mounted on the top of an OutBack PSDC disconnect enclosure. The MX60 will mount using 1" TSC threaded nipples to the locations shown below. One knockout is provided and one pilot hole for a second hole. Two MX60 controllers can also be mounted on the side of the PSDC enclosure using the optional OutBack CCB charge controller bracket.

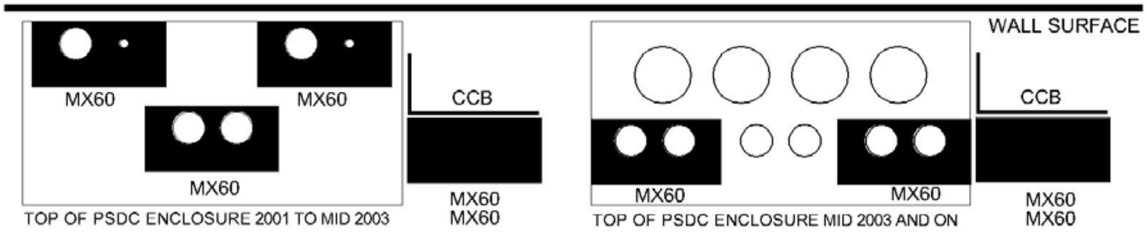

WALL SURFACE
MX60
MX60
MX60
CCB
MX60
MX60
TOP OF PSDC ENCLOSURE 2001 TO MID 2003
MX60
MX60
CCB
MX60
MX60
TOP OF PSDC ENCLOSURE MID 2003 AND ON

Figure 2 - Three MX60 mounting options on the top of an OutBack PSDC Disconnect Enclosure

A standard 1" TSC threaded nipple may be used to secure the controller to the PSDC top for many installations. All of the wires will fit through one knockout so the other can be used as a means of attachment. If one knockout is used for wiring, then drill through and bolt the MX60 to the PSDC top using a #10 (5mm) bolt, lock washers and nut. The use of a 7/8 inch spacer behind the MX60 when installed in either of the two rear positions will allow the mounting foot holes to be used to secure the chassis back to the wall.

When mounting the MX in a confined space, be careful not to block the fan opening or the air inlet holes towards the bottom of the chassis on either side. One side may be blocked, but not both. Although this will not damage the controller, it will decrease efficiency and may cause it to shut off due to an over temperature error.

WIRE AND DISCONNECT SIZING

When wiring the MX60 note that there is a current limit on the output at 60 amps and that the unit is listed to operate continuously at 60 amps. There is no 80% derating as required by the NEC for fuses, conductors, and most circuit breakers.

The MX60 is a buck type converter and can not boost the output current when the PV array peak power point voltage is at or below the battery voltage as may happen on hot days in 24VDC PV and a 24VDC battery system or a 48VDC PV and a 48VDC battery system.

This unit can supply up to 60 amps output depending on the nominal PV array voltage and the nominal battery voltage.

The output is current limited to 60 amps. To meet minimum NEC requirements, the output conductor should have an ampacity after any temperature and conduit fill corrections of 1.25 x 60=75 amps (NEC 310.15, 690.8,9). This would normally indicate that the output conductors would be 4 AWG, but a larger size may be required if there are temperature and/or conduit fill corrections required. With an output conductor rated at 75 amps (1.25 time continuous output current), a circuit breaker rated for continuous 100% duty at 60 amps (continuous output) like the OutBack OBDC-60 breaker may be used to provide the code-required disconnect and output circuit over current protection.

The PV array output connected to the MX60 input may be as high 60 amps, but at this current level, there is very little (if any) current boosting or maximum power-point tracking due to the 60-amp output current limit. Additionally, the input current may exceed 60 amps on bright sunny days and any excess power would be lost. The size and ampacity of the input conductors must be selected to handle 1.56 times the short-circuit current of the PV array. Any disconnect or circuit breaker connected to the input conductors must also be rated at 1.56 times the short-circuit current for the PV array unless the breaker is rated for 100% duty in its enclosure. If that is the case, the circuit breaker may be rated at 1.25 times the PV array short-circuit current. OutBack OBDC-XX breakers are 100% duty rated breakers.

In terms of NEC compliance and the 60-amp output rating on the MX60, the largest PV array that can be connected to the MX60 should have a rated short-circuit current of 48 amps. This will meet NEC requirements and allow the MX60 to perform maximum power-point tracking functions. The following charts show maximum distance in feet of various gauge two conductor copper wire from the PV array to the MX60 MPPT PV charge controller with a 1.5% maximum voltage drop. Temperature and conduit fill corrections may be required.

WIRE GAUGE

12 Volt PV Array

12 16V MPP Typical
Distance in Feet (Two Wires)
1.5% Voltage Drop
12 Volt Battery

Amps	#8	#6	#4	#2	#1/0	#2/0	#4/0
8	22	35	57	90	145	180	290
10	18	28	45	72	115	145	230
15	12	19	30	48	76	96	150
20	9	14	22	36	57	72	116
30	6	9	15	24	38	48	77
40	4	7	11	18	29	36	56
50	3	5	9	14	23	29	46
60	3	4	7	12	19	24	38

24 Volt PV Array

32V MPP Typical
Distance in Feet (Two Wires)
1.5% Voltage Drop
12 or 24 Battery System

Amps	#8	#6	#4	#2	#1/0	#2/0	#4/0
8	45	71	114	180	290	360	580
10	36	57	91	145	230	290	460
15	24	38	60	96	153	192	300
20	18	29	45	72	115	145	232
30	12	19	30	48	77	97	154
40	9	14	23	36	58	72	112
50	7	11	18	29	46	58	86
60	6	9	15	24	38	48	77

48 Volt PV Array

64V MPP Typical
Distance in Feet (Two Wires)
1.5% Voltage Drop
12, 24 or 48 Volt Battery System

Amps	#8	#6	#4	#2	#1/0	#2/0	#4/0
8	90	142	228	360	580	720	1160
10	72	114	182	290	460	580	920
15	48	76	120	192	306	384	600
20	36	58	90	144	230	290	464
30	24	38	60	96	154	194	308
40	18	28	46	72	116	144	224
50	14	22	36	58	92	116	172
60	12	19	30	48	77	97	154

60 Volt PV Array

80V MPP Typical
Distance in Feet (Two Wires)
1.5% Voltage Drop
12, 24 or 48 Volt Battery System

Amps	#8	#6	#4	#2	#1/0	#2/0	#4/0
8	112	177	285	450	725	900	1450
10	90	142	227	362	575	725	1150
15	60	95	150	240	382	480	750
20	45	72	112	180	287	362	580
30	30	47	75	120	192	230	385
40	22.5	35	57	90	145	180	280
50	17.5	27	45	72	115	145	215
60	15	23	37	60	96	121	192

72 Volt PV Array

96V MPP Typical
Distance in Feet (Two Wires)
1.5% Voltage Drop
12, 24 or 48 Volt Battery System

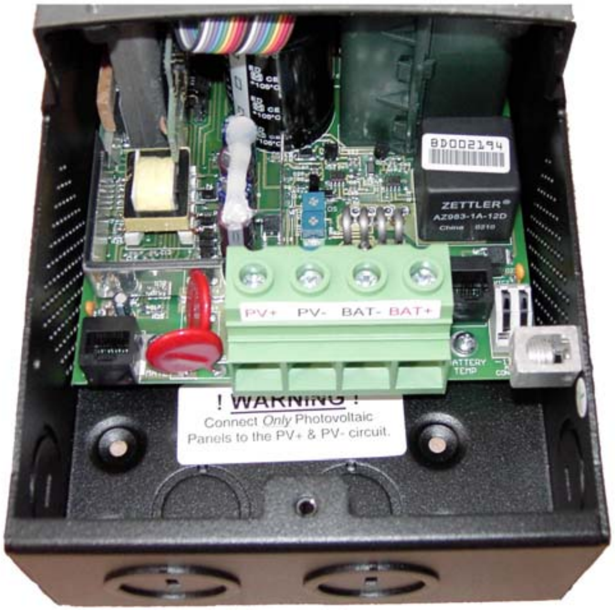
Amps	#8	#6	#4	#2	#1/0	#2/0	#4/0
8	140	221	356	562	906	1125	1812
10	113	178	284	453	719	906	1437
15	75	119	188	300	478	600	937
20	56	90	140	225	359	452	725
30	37	59	94	150	240	287	481
40	28	44	71	112	181	225	350
50	22	34	56	90	144	181	269
60	19	29	46	75	120	151	240

SURGE PROTECTION

Since PV Arrays are usually mounted on a roof or other elevated structure, protection from lightning induced power surges and other transient power disturbances between the PV array and the MX60 charge controller using a surge protection device on the input side of the MX60 is highly recommended. If the connection from the MX60 to the battery string is over 15 feet or if it is routed adjacent to other wiring or sources of power, surge protection on the battery side of the MX60 is also recommended.
Surge protection is required for extended warranty protection.

FIELD WIRING CONNECTIONS

The wiring terminals for the MX60 charge controller are shown in Figure 3. There is no required connection sequence.



PV+
PV-
BAT-
BAT+
BATTERY TEMP
! WARNING !
Connect *Only* Photovoltaic Panels to the PV+ & PV- circuit.
ZETTLER
AZ983-1A-12D

Figure 3 - MX60 wiring area and wiring terminals

NOTE: Each MX60 will need its own PV array. Do NOT parallel MX60 PV plus and minus terminals.

The large terminal block in the center is for, (left to right), PV+, PV-, BAT- and BAT+. The PV- and BAT- terminals are connected directly together underneath the terminal block, so one minus wire may be all that is necessary to run back to the main system minus tie point. The aluminum box lug terminal on the right side of the chassis is the equipment ground. The equipment-grounding terminal can be mounted on the outside of the enclosure if desired, although normally the equipment-grounding conductors will be routed in the same conduits with the input and output circuit conductors. If the equipment grounding terminal is moved to the outside, make sure that the star washer is re-used. This washer is used to penetrate through the paint, thus grounding the chassis. The NEC requires the use of an array disconnect and a battery disconnect. The MX60 can use a 60 amp 125VDC breaker such as the OBDC60 breaker.

All of the large terminals should be torqued to 30 inch pounds. The PV /BAT terminal and equipment ground terminal will accept up to 2AWG wire. An optional OutBack remote battery temperature sensor can be connected via the RJ11 “phone” type jack marked ”Battery Temp” to the right of the BAT+ terminal. This sensor is mounted on one of the batteries using the double back tape included. Battery manufacturers recommended charging voltages are based on 77˚F / 25˚C. Your batteries will not be properly charged using the manufacturer’s set points without a remote sensor unless the batteries remain at 77˚F / 25˚C. The OutBack Temp sensor will automatically change the set point voltages up or down depending on the battery's temperature. This is especially important in very cold or very hot climates. The battery temperature sensor is a highly recomended option. With the Mate and Hub, only one battery temperature sensor is needed for multiple FX inverters and MX60s. The master FX or MX, plugged into port one of the hub, reads its temp sensor and distributes that information to the other units. If the system contains an FX, then it needs to be the master and have the battery temperature sensor plugged into it. If using a combination of FX's and MX's, the FX inverter must be the port one 1master.

To the right of the temp sense jack is a small two position terminal block marked AUX. The terminals are marked Ground and +12V. The terminals are programmable to accomplish an assortment of functions such as load diversion or alarms. The max current available on this terminal block is 200 milliamps. This is enough to power the coil of a small relay, piezo buzzer, or LED indicator. The AUX output is protected internally by an automatic resetting poly-fuse device. This may not directly drive a Mercury Displacement Relay because of their high turn-on surge requirement, but a smaller external relay may be used to indirectly operate bigger relay or contactor coils. The Aux output can be programmed to be Active High or Active Low for all of the Aux output functions.

To the left of the PV+ terminal is an RJ45 jack marked MATE. The OutBack MATE remote control or HUB connected to a mate would be plugged in to this jack. The MATE can be used to remotely display the MX60 status and to trigger multiple MX60s for certain functions such as Equalization.

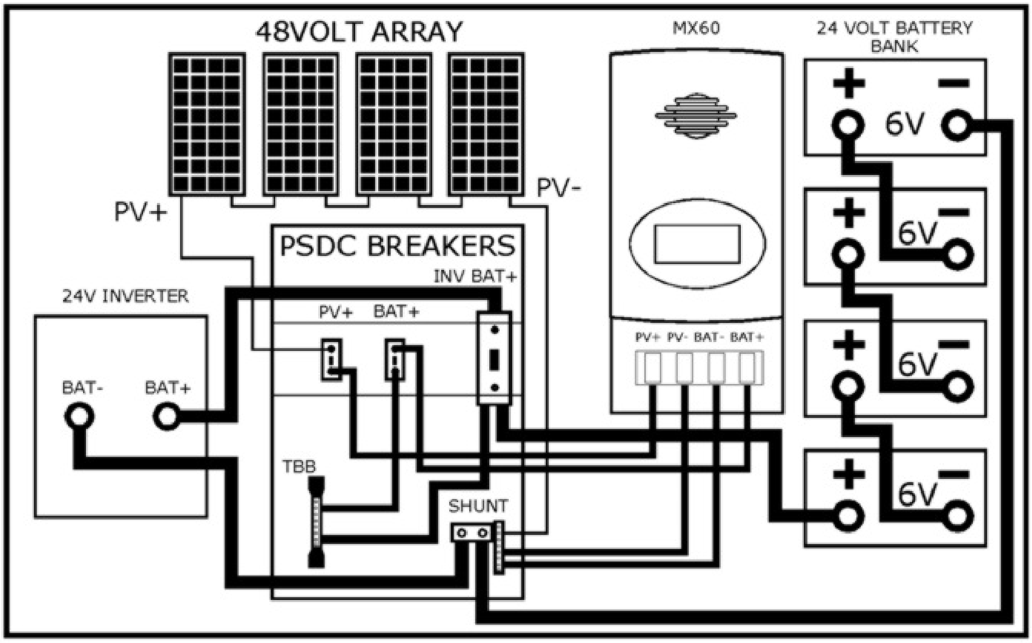
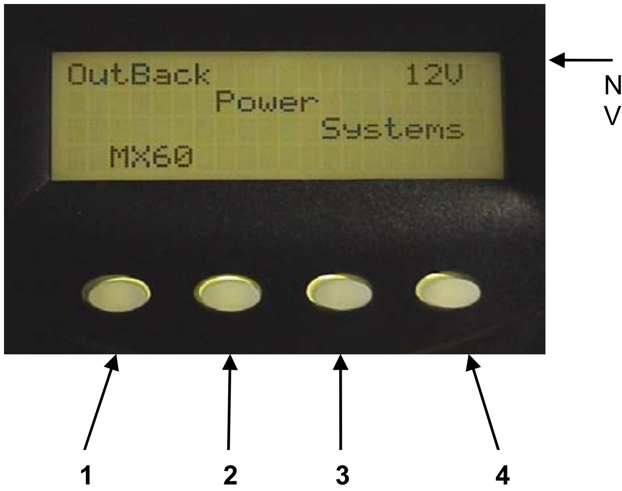


Figure 4 - The OutBack MX60 with PSDC Enclosure

Power Up Screen



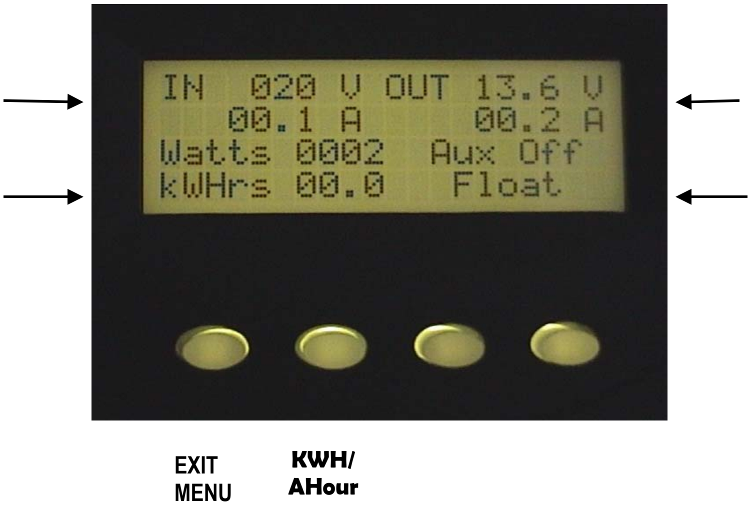
Soft Key number 1 is the **EXIT** key for most screens

Nominal System Voltage appears in the upper right-hand corner

Figure 5 - MX60 Power Up / Start-up Screen
Note that the user selected nominal battery system voltage is shown in the upper right corner.

OPERATIONAL STATUS

The MX60 Charge Controller has a 4 line, 80 character LCD display and four "soft key" buttons to allow the user to adjust battery charging parameters and access other information. Figure 6 shows the main Status (Home) Screen. This screen shows the following information:



Input Voltage and Current on the Left

KiloWatt - Hours or Amp Hours can be displayed

Output Voltage and current on the Right

Brief description of present MX60 operation

Figure 6 –MX60 Home Status Screen

First Line	Input voltage	Battery (output) voltage
Second Line	INPUT Current Amps	Current out to battery system
Third Line	Instantaneous output watts	Aux Output terminal status
Fourth Line	Daily KWh /AmpHours produced	Mode of operation

Pressing the left button, (**EXIT**), takes you to the main menu screen and holding button 2 toggles the MX60 between **Amp Hours** and **kW Hours** display mode. Pressing buttons 3 and 4 simultaneously (for a moment) in MPPT mode will usually force a mini sweep of the PV input.

OPERATIONAL MODES

The modes of operation will change occasionally during the day based on PV array output and battery system state of charge. The MX60 operating mode, (and sometimes other messages), are displayed in the bottom right hand corner of the main status screen (figure 6).

Sleeping PV output voltage is less than battery voltage or charger current is below the minimum cutoff current. This may also appear briefly during the day when the MX60 is transitioning between certain states and because of other conditions.

Zzzz... After nite time, (3 hours of Sleeping), the MX60 will display Zzzz... until the next wakeup. At this next wakeup, (usually the next morning), the daily statistics, (AmpHours, KWh, etc.), will accumulate into the total statistics and then the displayed daily statistics will clear.

Wakeup As the PV open circuit voltage, (Voc), rises above the battery system voltage, the MX60 prepares to deliver power to the batteries. During this period, the MX is calculating PWM duty cycles, turning on power supply voltages in the proper sequences, and making internal calibrations. At wakeup, the MX60 closes its relays and will then start sweeping the input voltage, (the “initial” sweep), down towards the battery voltage. At dawn and dusk this may happen many times until there is (or is not) enough power from the PV array to keep going. Wakeup is also a time when the MX60 acquires a new Voc.

Sweeping In Auto-Sweep MPPT mode, the MX60 is either doing an initial sweep of the panel voltage from Voc towards battery voltage after wakeup, or is doing a periodic dithering mini-sweep to stay on the max power point. Below 5 amps of battery output current, this will flash briefly as the MX60 operates at the **Park Mpp** voltage. This message may also appear briefly if the MX60 has reached the max battery current setting and is raising the PV operating voltage to keep the battery current from exceeding the maximum battery output current limit setting. (*see max absorb time and sweep interval*)

MPPT The MX60 is in Maximum Power Point Tracking mode and is trying to get the battery voltage to reach the Absorb or Float voltage set point in the Bulk or Float charge stages. If the MX60 is in the Bulk charge stage, the Charge Timer (*see ChgT Misc screen 1*), will count up to the max Absorb time.

Absorbing The MX60 is in the Absorb (constant voltage) charge stage, keeping the battery voltage at the Absorb voltage set point, (modified by battery temperature compensation if installed), and the ChgT counter in the miscellaneous screen is counting down towards zero from however long the MX60 was in Bulk. If the system cannot keep the battery voltage at the Absorb voltage set point, then the MX60 will return to the Bulk charge stage, display MPPT, and the ChgT counter will start counting up again towards the MAX Absorb time setpoint.

Absorb There is an external DC source keeping the battery at or above the Absorb set point.

Bat Full The MX60 is waiting for the battery voltage to fall to just below the Float voltage set point before continuing with the Float stage. This may also be displayed when external DC charging sources are present.

Float The MX60 is in the Float charge stage and is keeping the battery at the Float voltage set point. If the system cannot keep up with the Float voltage set point, (e.g. DC loads are on), then the MX60 will return to MPPTing, display MPPT, and try it’s best at again reaching the Float set point target voltage.

New Voc The MX60 is acquiring a new open circuit panel voltage periodically in the U-Pick MPPT mode.

Re-Cal There are certain abnormal conditions that can confuse the current measuring method in the MX. When and if this happens, the MX will temporarily stop and re-calibrate. This may sometimes happen because of negative current, i.e., current coming out of the input terminals instead of into the input terminals, or a tripped PV breaker. A new Voc is also acquired during a Re-Cal.

Bat Tmp Err The battery temperature sensor is shorted. The MX60 will stop operating unless the sensor is removed or replaced with a new sensor.

EQ MPPT The equalization process has been manually started and the MX60 is seeking the Equalization voltage set point (EQ is NOT battery temperature compensated). The AUX output will be disabled in all but the manual On mode. After the EQ voltage has been reached, EQ 0:00 will be displayed and the EQualization time in hours and minutes will be displayed. The DC loads should be turned off and the battery should be charged enough so that the MX60 can reach the EQ voltage set point, otherwise the MX60 cannot start the EQ cycle. The EQ cycle is not continued into the next day if it did not complete on the day it was initiated.

EQ 0:00 This message shows that the EQ cycle has started and shows how long it has progressed in Hours:minutes.

EQ DONE Once the set EQ time, (1 to 7 hours), has successfully completed, EQ DONE will be displayed either until a button is pressed, or the next morning's wakeup.

Low Light / Snoozing During the initial sweep, (see Wakeup and Sweeping), if it is determined that it is too late (or too early), in the day, the MX60 will display Low Light for a few seconds, then display Snoozing for 5 minutes, which is a form or sleeping. This is meant to reduce energy and unnecessary powering of the MX. This can of course be displayed in extremely cloudy weather. The snoozing mode can be disabled and has 2 basic modes to choose from. One mode is based on the speed of the ability of the PV to charge the input capacitors and another mode looks at the initial wakeup sweep current to see if it reached the low cutoff current set point.

Unloaded The battery terminals were abruptly unloaded. May be displayed if the battery breaker trips while MPPTing or the system voltage is set too low.

AutoStart (Auto Re-Start) Once every hour, in MPPT mode, and once every 90 minutes, in the Absorb and Float charge modes, the MX60 will start over from sleep and re-sweep (full sweep) and re-calibrate the current sensor. This can either be disabled completely, selected to only Auto Re-Start in MPPT mode, or Re-Start in MPPT and Absorb/Float charge mode. It is recommended that this mode be left to mode 2, Auto Re-Start in all 3 charger modes. (see LOG2 screen)

MXTooHot (Very rare) Either the MX60 is just too hot or its internal temperature sensor is shorted.
If you do get this message, check (very carefully) to see if the MX60 is really hot on the outside heatsink. The heat generated by the MX60, and therefore its losses, are proportional to input voltage times output current. It is also a good idea to NOT install the MX60 in direct sunlight.

SysError (Very rare) System Error means that there was an internal non-volatile memory error. The unit will stop operating when this message is displayed. Call the factory if you see this message.

PASSWORD

The MX60 has a set point adjustment lockout that requires an access code to make many changes to the controller's operation. The password is **141.** When the MX60 asks for the password, press - (decrement) until the number reaches 141, and then press ENTER. You will not need to enter the password again until either 10 minutes passes, or, you un-power and re-power the unit. Every time you press a button, after entering the correct password, you have 10 minutes until the MX60 locks you out again, and need to re-enter the password. IF you decide that you do not want to make any changes, just hit **ENTER** with the incorrect password, and continue from there.

DEFAULT CHARGER VOLTAGES

The MX60 is factory preconfigured for a 12V battery system. All of the default settings are multiples of 12V nominal settings. The default bulk termination, or Absorb and EQ voltage setting is 14.3 VDC, and the default Float setting is 13.6 VDC. The default current limit is set to 60 Amps.

SYSTEM CONFIGURATION

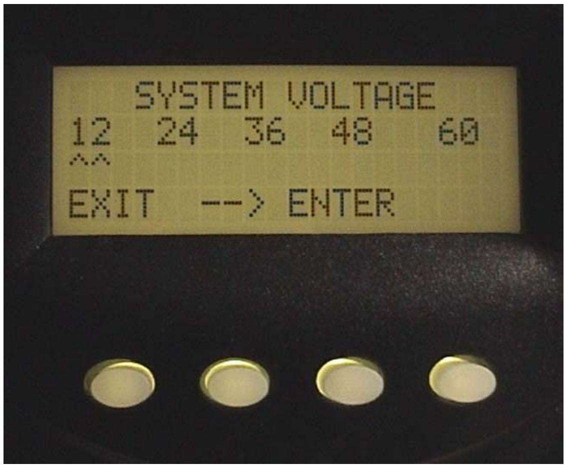
YOU MUST SELECT THE BATTERY SYSTEM VOLTAGE FIRST!

Battery System Voltage: The nominal battery system voltage can be changed from the default of a 12 volt battery to match your particular battery system. Only the battery system voltage needs to be set. The MX60 automatically senses the nominal PV array voltage and finds the maximum power point during operation. Fine tuning can be adjusted later if needed.

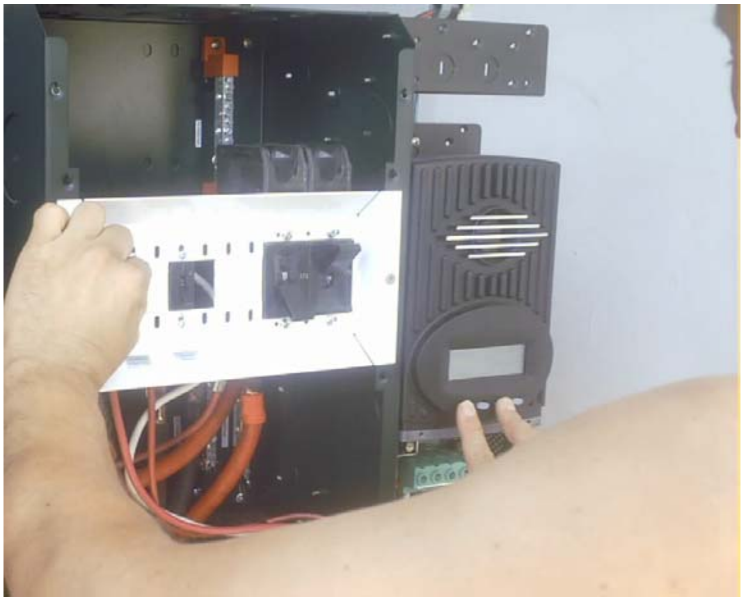
Setting the nominal battery system voltage will require entering a password to change the values. The following password is required for this unit: **141** Use the following procedure to change parameters:

1. Start with the Battery switched off
2. Hold down push buttons #1 and #3. (From left to right the buttons are #1 #2 #3 and #4)
3. Turn battery breaker / disconnect on while holding buttons #1 and #3 down.
4. Release both of the buttons once "OutBack Power Systems" appears on the LCD screen.
5. You will now be at the voltage selection screen. Pressing --> or **ENTER** will require the password.
6. Push **-** (minus) until the number reaches **141**. Press the button below the word "**ENTER**".
7. Press the button below "**NEXT**" to select the nominal battery voltage of your system, then press "**ENTER**". The MX60 will ask "**ARE YOU SURE?**" When you push the "**YES**" button, the unit will reset and then display the signon screen (with system voltage in the upper right corner) and Status Screen

8. To reset these parameters to the factory defaults, repeat steps 1 through 7 above. The actual Absorb and Float voltages will be modified automatically with the use of the external temperature sensor. You can view the compensated voltages in the **Miscellaneous 1 Screen.** The compensation provided is -30 millivolts per degree Celsius for a 12 VDC system. This amount is automatically doubled for a 24 VDC system, quadrupled for a 48 VDC system, etc. If, after entering the system voltage setup screen you press **EXIT**, or just let it sit in this screen for 5 minutes without pressing any buttons, the MX60 will automatically start operating at the previous system voltage setting. Many MX60 factory set parameters can be changed by the user. Disconnecting the MX60 from the battery will not require re-programming.

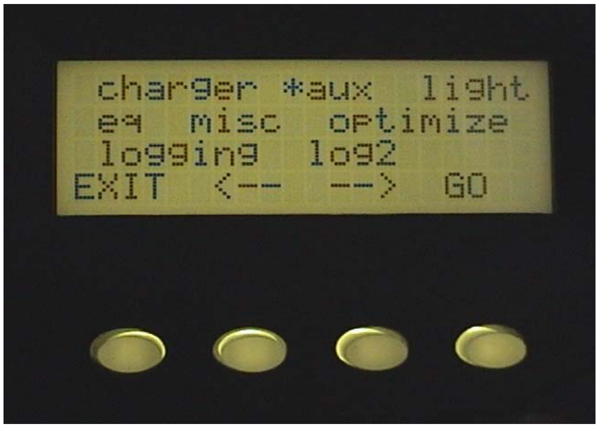


System Voltage Setup Screen



Setting system Voltage with the "Mind Meld"

Main Menu



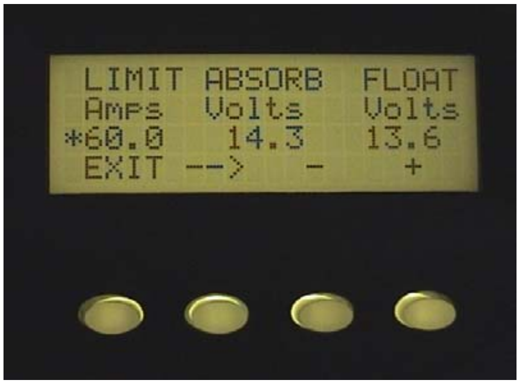
Press ← or → to align the asterisk * to the left of the desired screen

Press **"GO"** to take you to the highlighted screen. **EXIT** returns to the main status screen

Figure 7 - Main Menu Screen

The MX60 powers up (resets) to the **STATUS** screen mentioned in the Operational status section. This main status screen is the MX60s HOME screen. There are no highlighted soft keys in this main STATUS screen. To reach the main **MENU** screen, press button number 1, the left button from the STATUS screen. You will see the screen of selectable menus as in Figure 7 above. From here, press NEXT or BACK to align the asterisk in front of the menu you would like, then press **GO**. From the menu you have gone to, hitting **EXIT** from that screen will return you to the main STATUS home screen and save any data that has been changed into non-volatile memory. Pressing EXIT from the Menu screen will bring you back to the home STATUS screen again.

Charger Setup



```
 LIMIT ABSORB  FLOAT
 Amps  Volts   Volts
*60.0   14.3   13.6
 EXIT -->   -    +
```

Pressing → Selects which parameter you are going to Increase or Decrease

Press "**EXIT**" to save the new settings & return to the Status Screen

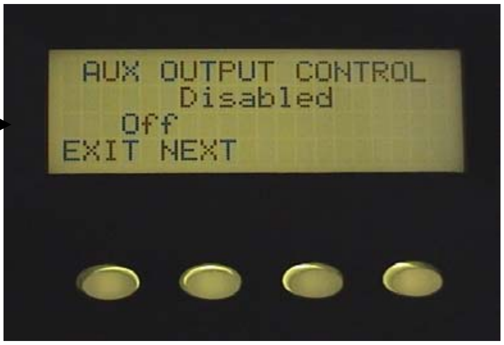
Figure 8 - Charger Set-up Screen

The charger parameters are automatically set to defaults when the nominal battery system voltage is set, and can be user modified. The default ABSORB and FLOAT Voltage set points are based on typical lead acid battery systems. The default charger current limit is 60 Amps and can be changed for circuit breaker or wire size limitations and is adjustable to 70 Amps for those of you that actually read this manual. The words "Absorb Volts", "Bulk Volts", or, "Bulk *termination* Volts" are synonymous here. The Bulk cycle reaches the "Absorb" voltage set point and continues the Absorb stage at that voltage.

If the manufacturer of the batteries you are using recommends different ABSORB and FLOAT Volts set points, you can change the set points using the Charger Set-Up Screen shown in Figure 8. The actual target voltages will be different if a battery temperature sensor is installed, and those values can be viewed in the **miscellaneous** screen next to the **Tmp Comp** heading.

Pressing → selects which parameter you are going to increase or decrease. The presently selected parameter will have an asterisk * to the left of it. You may need to re-enter the password to change these settings.

Aux Output



```
AUX OUTPUT CONTROL
   Disabled
 Off
EXIT NEXT
```

The On and Off indicator shows the present state of the Aux terminals. On indicates 12V DC is present at the terminals.

Press **NEXT** to select another Aux function

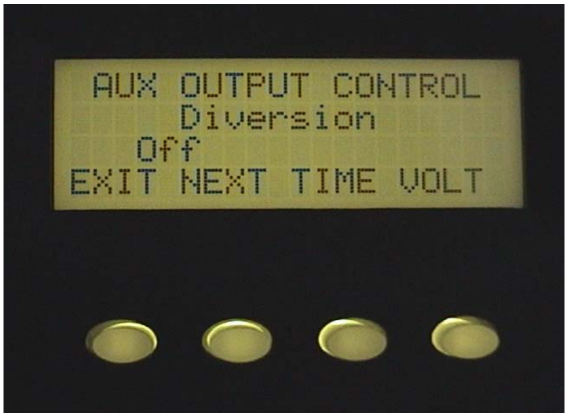
Figure 9 - Auxilliary Output Set-up Screen

Aux Output: The user can set the function for this secondary control circuit. The choices are: Manual, Disabled, Diversion, Low Battery Disconnect, Remote, Vent Fan, PV Trigger, Night Light, and Float stage or Current into the battery. The terminals marked "AUX", supply a 12 VDC (nominal) at 200 milliamp max output current to drive a small relay coil, 12V LED indicator, piezo buzzer, or a solid state relay. The Optimization menu allows you to change the Aux Output from **Active High** (default) to **Active Low**, which inverts the Aux Output terminals and supplies 12V when the function is inactive instead of 0 volts. For example, the Active Low option could turn Low Battery Disconnect mode into a Diversion function. In either case, Active High or Active Low, "**On**" (on the LCD) means that **12 volts is present** at the Aux terminals and "**Off**" means **0 volts is present** at the Aux terminals.

Disabled: The Aux output terminals have no output if in Active High mode, or 12V if Active Low.

Manual: Activates or Inactivates the Aux output manually from the MX60 keypad. Press ON or OFF to Activate or De-Activate the Aux output.

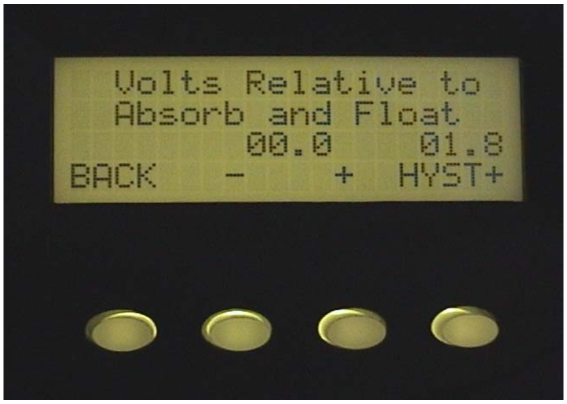
Diversion: Used when a wind or hydro generator is connected directly to the batteries and excess power needs to be diverted away when the battery is full. The AUX output terminals will become active when the battery voltage reaches the ABSORB or FLOAT voltage relative to an adjustable value. The value is adjustable in tenths of a volt from -5.0 volts to 5.0 volts Relative to the ABSORB or FLOAT set point (temperature compensated Absorb or Float V set point if the OutBack RTS is installed). A Hysteresis (HYST) adjustment controls when the Aux output will go inactive again, after the battery voltage falls below the RELATIVE voltage *minus* the HYST voltage value. The HOLD time determines the *minimum* time the output stays active after the battery voltage falls below the hysteresis voltage.



```
AUX OUTPUT CONTROL
   Diversion
 Off
EXIT NEXT TIME VOLT
```

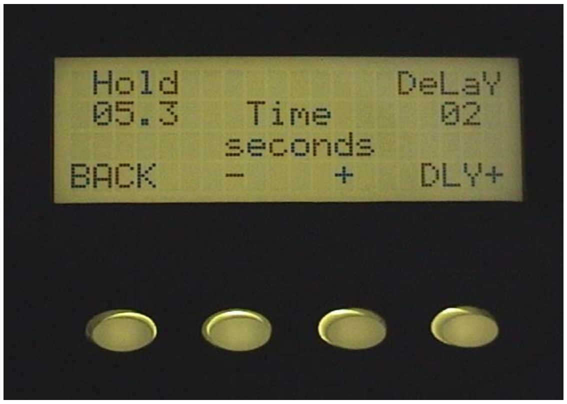
Pressing **TIME** or **VOLT** takes you to those diversion setup screens

Figure 10 – Aux Diversion main menu



Volts Relative to
Absorb and Float
00.0 01.8
BACK - + HYST+

Figure 11 –Diversion VOLT setup screen



Hold DeLaY
05.3 Time 02
seconds
BACK - + DLY+

Figure 12 –Diversion TIME setup screen

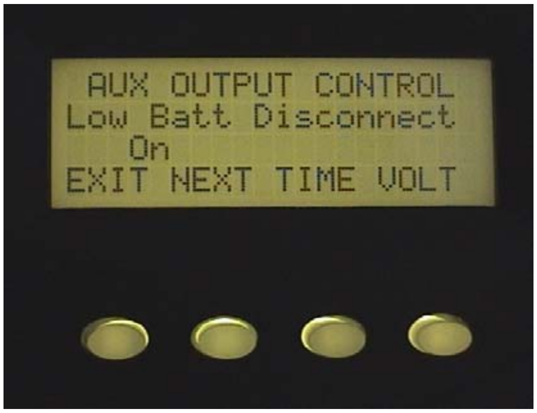
Diversion Volt The + and – buttons adjust the trip point voltage *relative* to the Absorb or Float set point voltage necessary to activate the Aux output terminals. For example, if the MX60 was in the Float charge stage, and the battery voltage went above the Float voltage, *plus* this relative voltage, (*minus* this voltage if its polarity is -), the Aux output terminals would go active as long as the battery voltage stays there for at least the **DELAY** time.

If HYSTeresis is set to something other than zero, then the battery voltage must fall to the *relative* voltage *minus* the HYST voltage value, and stay below the *relative* voltage minus the HYST voltage before the Aux output will deactivate. For example, if the Float voltage, (temperature compensated), is 13.6 Volts, HYST is 1.8 volts, as in the above picture, and the Aux output was active due to the battery voltage going above the trip point longer than the delay time, the Aux output will go inactive when the battery voltage goes below 13.6 minus 1.8 volts, or below 11.8 Volts. The Aux output will not de-activate though until the HOLD time is reached.

Diversion Time The **DELAY** time (**DLY**) *before* the Aux output activates (after going above the "Relative" voltage) is adjustable from 0 to 24 seconds in 1 second intervals. Pressing **DLY+** will increment the Delay time and wrap around back to zero after reaching 24.

The **HOLD** time, (adjustable from 0.1 to 25.0 seconds), dictates how long the Aux output will stay active *after* the battery voltage has fallen below the hysteresis (**HYST)** set point. Pressing + increments this time and – decrements back towards zero seconds.

Low Battery Disconnect: The Aux output terminals ACTIVATE when the battery voltage drops below the low battery set point voltage for an adjustable delay time, and De-Activate when the battery voltage exceeds the reconnect voltage set point after the same amount of delay time. The time delay is adjustable from 0 to 250 seconds.



AUX OUTPUT CONTROL
Low Batt Disconnect
On
EXIT NEXT TIME VOLT

Figure 13 –Low Battery Disconnect main screen

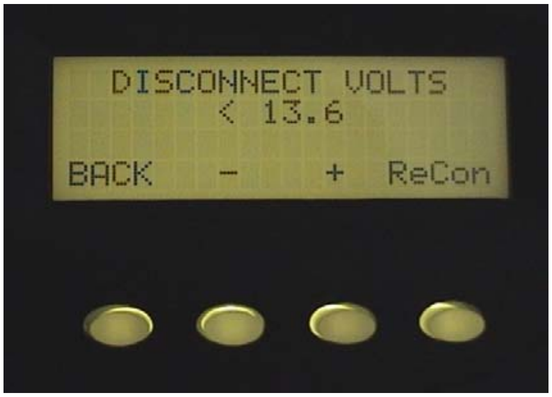

DISCONNECT VOLTS
< 13.6

Figure 14–Low Battery Disconnect Volts Setup

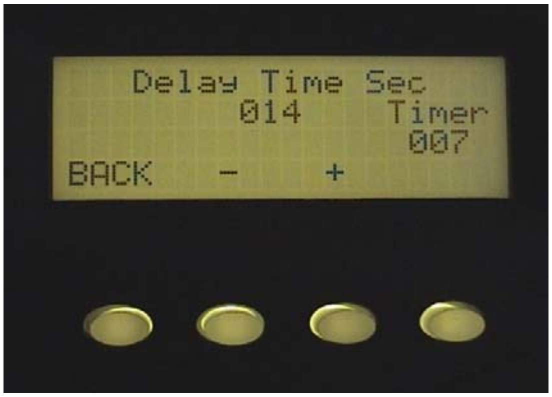

Delay Time Sec
014 Timer
007

Figure 15 –Low Battery Disconnect delay time

LBD Disconnect/Reconnect Voltage Figure 14 shows the Low Battery Disconnect VOLT setup screen. Pressing button 4 will toggle between the Reconnect (ReCon) screen and the Disconnect (DisV) voltage screens. In this example, the Aux output will go **active** when the battery voltage goes *below* 13.6 Volts for 14 seconds, and it will DeActivate when the battery voltage goes above the ReConnect Voltage setpoint, after the timer has counted back to zero.

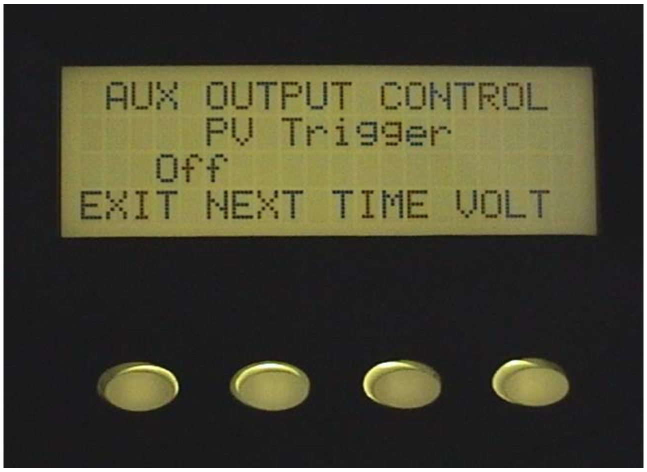
LBD Delay Time Figure 15 shows the Delay Timer setup screen. Assuming that the Aux output was *Inactive*, because the battery voltage was above the Reconnect voltage, when the battery voltage falls *below* the Disconnect voltage setpoint, the Delay Timer will count up to the delay time setpoint (in seconds), and as soon as that time is reached, the Aux output will go Active (and presumably turn off a load). When the battery voltage rises *above* the Reconnect voltage setpoint, the Timer will count *down* again, towards zero, and when it reaches zero, the Aux output will go Inactive, turning the load back on again.
If, instead, you would rather that the Aux output emits zero (0) volts when you want the loads to disconnect, and 12 volts when they are connected, the Optimization setup menu will allow you to reverse this relationship by changing the Aux output polarity to Active Low, instead of Active High (the MX60 default)

Remote: An OutBack MATE can control the operation of the Aux output of the MX60 controller if this is selected. Only one MX or FX devices Aux control output can be *automatically* controlled by the MATE at a time.

Vent Fan: The Aux output becomes active when the battery voltage exceeds the Vent Fan voltage setting. This mode is useful for controlling a fan for venting hydrogen out of a battery room, or triggering an over-voltage alarm. The Aux output will stay active for at least 30 seconds after the Vent Fan voltage is exceeded.

Night Light: Night Light mode Activates the Aux output at Night time. Night occurs after 7 minutes of sleep and De-activates the Aux output at the next MX60 Wakeup.

PV Trigger: Activates the Aux output when the PV input exceeds the voltage set point for a minimum adjustable amount of hold time. This might be useful for sounding an alarm if the MX60 input terminals go beyond a certain voltage. Figure 16 shows the main PV trigger Aux screen.



```
AUX OUTPUT CONTROL
   PV Trigger
 Off
EXIT NEXT TIME VOLT
```

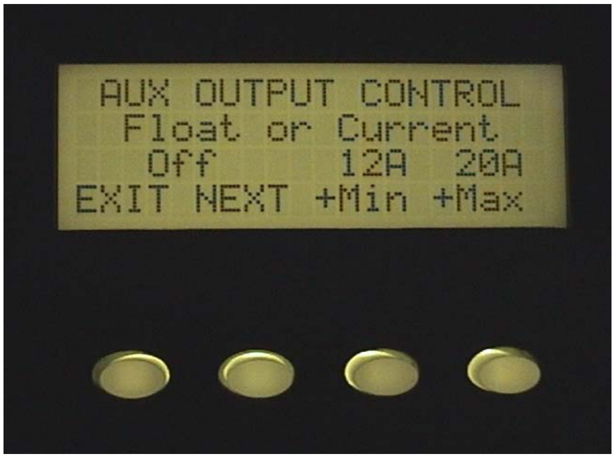
VOLT adjusts the PV input voltage, above which the output will go Active. Adjustable from 20 to 140 Volts

TIME adjusts the minimum Aux output **HOLD time** from 0 to 25 Seconds

Figure 16- PV Trigger Main screen

The maximum input voltage for an MX60 should not exceed 140 Volts, which can happen if a 72 volt nominal array is used, in sub-zero temperatures. Do not use it to operate a diversion load across the PV terminals, however, this mode *could* be used to operate a series latching relay that disconnects the PV array if the voltage goes higher than the voltage set point. Watch for a future active voltage clamp/diversion product that keeps input voltages from going beyond a set ceiling voltage. Micro-Hydro and wind will then be better suited to take advantage of MX60s current boost technology. As it is now, you must be sure the input will not exceed the MX60 ratings. Many are already using the MX60 with Micro-Hydro as a series controller.

Float or Output Current: This mode may be used to enable a load only when the MX60 is producing power or if the MX60 is in the float stage. An example may be to turn on a water pump. The Aux output will not go active until the output current is at or above the **Max** (right hand number) Current. The Aux output will inactive again when the Current falls below the **Min** Current.



```
AUX OUTPUT CONTROL
 Float or Current
  Off      12A  20A
EXIT NEXT +Min +Max
```

Aux Output will go active when Max Amps setting is exceeded if it is other than 00

Aux output goes Active when the MX60 is in Float and Min and Max are 00 Amps

Figure 17 – Float or Current output trigger

If both Min and Max Amps are 00, then the Aux output will go active whenever the MX60 is in the Float stage.

Backlight Control: The backlighting of the LCD screen and the buttons consumes about ¾ watt. The user can control backlight options using the setup screen shown in Figure 18. Depending on your energy production, you may elect to leave the lighting off or on. There is also a third option called Auto. Tapping any key quickly while in Auto mode will turn the BackLight lights on for 60 seconds. This fast tap to turn on the backlight will not change any of the settings.

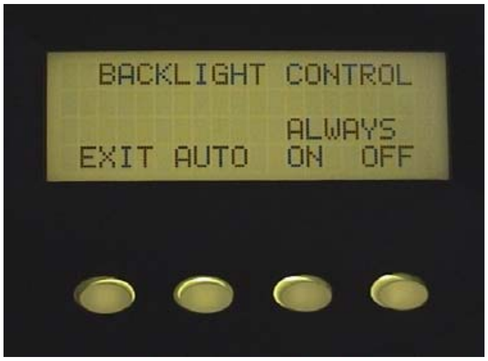
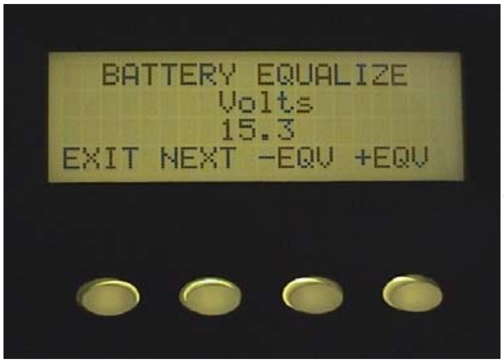


Figure 18 - Backlight Control Set-up Screen

Battery Equalization: Flooded electrolyte batteries should occasionally be subjected to an equalization process to convert sulfation from the lead plates. This process can be dangerous, so make sure you understand it completely before equalizing your batteries! The default EQ settings are: equalize voltage set the same as the Absorb voltage and equalize time set to one hour. The screens shown in Figures 19 through 21 allow the user to change the equalization voltage set point and time limit as well as start or stop the equalization process. This EQ voltage is also the voltage used when a global equalization is triggered remotely. The DC loads should be turned off and the battery should be charged enough so that the MX60 can reach the EQ set point voltage.

NOTE: VALVE REGULATED LEAD ACID (VLRA) OR OTHER SEALED TYPE BATTERIES SHOULD NOT BE EQUALIZED UNLESS SPECIFICALLY RECOMMENDED BY THE BATTERY MANUFACTURER


BATTERY EQUALIZE
Volts
15.3

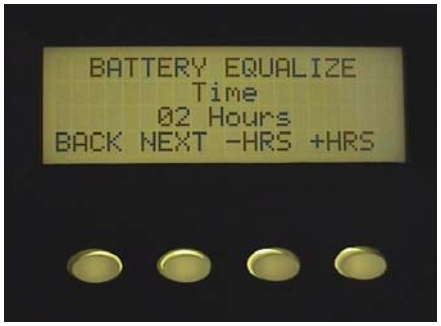
Press –EQV and +EQV to change EQ voltage

Press "**NEXT**" to continue to the battery equalization time set-up screen

Figure 19 - Battery Equalization Voltage Set-up Screen

Battery Equalization: (continued.....)

Press **–HRS** and **+HRS** to set the desired equalization time

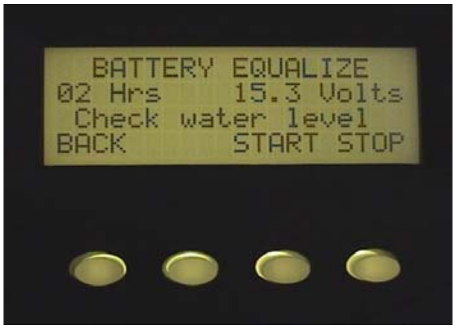


```
 BATTERY EQUALIZE
       Time
     02 Hours
BACK NEXT -HRS +HRS
```

Press "**NEXT**" to continue to the battery equalization start screen

Figure 20 - Battery Equalization Time Set-up Screen

Notice the reminder to check your battery water level



```
 BATTERY EQUALIZE
02 Hrs    15.3 Volts
 Check water level
BACK      START STOP
```

User Configuration Complete

Press "**STOP**" or "**START**" Return to the status screen

Figure 21 - Battery Equalization Start Screen

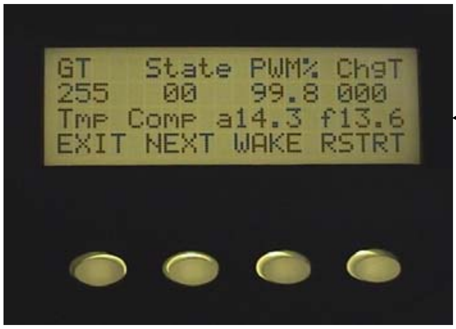
The Battery equalization process must be started manually, either from the MX60 or from a compatible MATE/FX and hub networked system. The screen shown in Figure 21 is used to start the equalization process. The EQ process is automatically terminated once the EQ time period has been reached. After an EQ has terminated, the MX60 will be in the Float charge stage.

After an EQ has been started, the main status screen will show whether the MX60 is MPPTing and trying to reach the EQ voltage, or if it has, it will show EQ and the elapsed EQ time in Hours:Minutes.

Pressing "Stop" will over-ride the timed EQ and return the controller to the Float stage. If an equalization has been started, but not completed on the same day, it will not be continued into the next day. You will need to re-start the EQ process.

Miscellaneous Screens:

The screens shown in Figures 22, 23 and 24 are for extra settings and technical information. Phone calls to OutBack may require reporting some of these values for troubleshooting purposes. The following is a brief description of the contents of these screens:



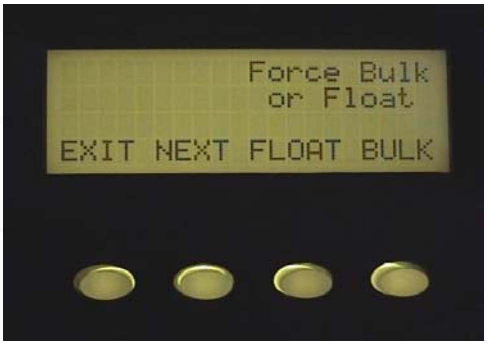
```
GT   State PWM% ChgT
255   00   99.8 000
Tmp Comp a14.3 f13.6
EXIT NEXT WAKE RSTRT
```

Press “**NEXT**” to Continue to the Force Bulk/Float Screen

The battery temperature compensated absorb and float voltage setpoints are visible on line 3

Figure 22 - Miscellaneous Screen 1

GT	GridTie value sent from the FX inverter through the MATE for GridTie control communications. An “X” to the right, means that an FX is in GridTie mode and is sending control information to MX60s. (See Optimization menu/MPPT MODE---non-GT/FX-GT)
State	The MX60 has thousands of lines of code. Each MPPT operation is called a State. This number is useful for troubleshooting and may be asked for when calling the factory.
PWM%	The duty cycle of the buck converter. At 50%, the PV terminals would be twice battery voltage.
ChgT	The minute counter for the Absorption cycle. It counts up from the minimum absorb time, normally 000, while in the Bulk cycle, and then counts down (in minutes) from a maximum Absorption cycle time. This allows the MX60 to enter the Float stage sooner when the controller starts the charging process with a full battery. The Absorb stage can sometimes be abbreviated and end sooner by setting the Absorb ending Amps to a value other than 00 Amps. (see the MISC 3 screen)
TmpComp	Battery temperature compensated absorb and float set points. The set points will rise when the battery is cold and will be lowered when the battery is hot. If no external battery temperature sensor is plugged in, these numbers will equal those found in the charger settings screen.
Wake	Allows manual wakeup when the MX60 has started the 5 minute snoozing.
Rstrt	Forces the MX60 to restart from sleep mode.



```
          Force Bulk
           or Float

EXIT NEXT FLOAT BULK
```

Press “**NEXT**” to continue to Miscellaneous Screen No. 3

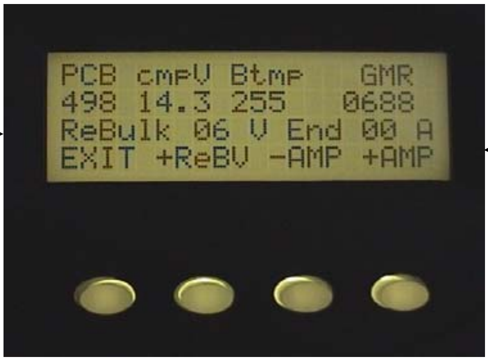
Pushing Button 3 or 4 Forces the MX60 to the Float or Bulk charge stage

Figure 23 - Miscellaneous Screen 2

Force Bulk or Float:

Pushing the button under FLOAT or BULK will force the MX60 into that charge state and return to the main Status screen.

ReBulk will re-initiate another daily bulk charge cycle if battery voltage falls below this value for 90 seconds. Default of 6 Volts is disabled



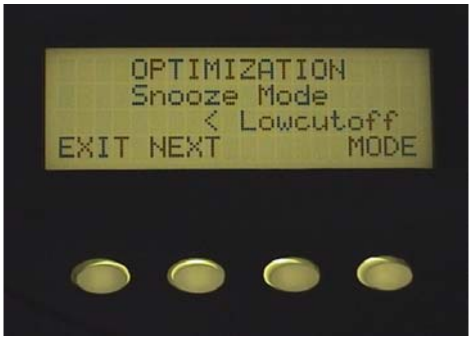
```
PCB cmpV Btmp   GMR
498 14.3 255   0688
ReBulk 06 V End 00 A
EXIT +ReBV -AMP +AMP
```

Absorb Ending Amps can modify how long the Absorb cycle lasts

Figure 24- Miscellaneous Screen 3

PCB	Temperature measurement value used to control the cooling fan's operation and to provide over temperature protection of the internal electronic components. This temperature measurement is not the actual internal temperature in degrees C or F but is an arbitrary number used for reference. The lower the number, the higher the temperature. 25 degrees C is approximately a value of 525.
CmpV	Temperature compensated Absorb or Float set point voltage that the controller is currently using as the regulation target.
Btmp	Battery temperature sensor reference value used to compensate the charging process. This is an arbitrary number between 0 and 255 and is not the actual temperature in degrees C or F. An 'X' next to this value indicates a Global eXternal BTS is being used.
GMR	Output value of the internal current sensor used to calculate output amps, watts and track the Max Power Point of the input.
ReBulk	If the battery Voltage goes *below* the ReBulk Voltage set point for at least 90 seconds, the MX60 will reinitiate a Bulk charge cycle. The default is set to a very low value (6 Volts) and therefore the function will be disabled.
+ReBV	ReBV increments the ReBulk Voltage. It will wrap around to the low 6 Volt value when 69 is reached.
End **-EndA** **+EndA**	Normally an absorb charge cycle is terminated because the battery voltage was regulated at the Absorb set point for the maximum time period. Decreasing (-**AMP**) or increasing (+**AMP**) sets an optional end current level in DC amps, displayed as the **End** number in amps. While the MX60 is regulating the charging process in the Absorb stage, and the end current level is reached before the charge timer has reached zero, (ChgT in Figure 22), the MX60 will switch to the Float charge stage. This is an optional set point and is not required to be adjusted in most installations. Zero Absorb end amps is the default and means that this feature is disabled.

Optimization Menus


OPTIMIZATION
Snooze Mode
< Lowcutoff

Press **EXIT** to return
to the
Main Status Screen

Press **NEXT** to
access the next
OPTIMIZATION
setting

Figure 25 - Snooze Mode

Snooze Mode:

Very early or very late in the day, when it is twilight, the resistance of the panels are high. However, there may be enough open circuit panel voltage that the MX60 will want to wake up and operate when there is not really enough power to do any useful charging. Instead of waking and clicking and operating unnecessarily, the MX60 can try to ”snooze” for a few minutes and ignore this Voc. There are moments in the MX60s operation where the MX60 can look at the voltage rise time of the panels at the PV side capacitors and snooze if the panel voltage did not rise to the last measured panel Voc. After enough light is shining on the panels, the panel resistance goes down enough that the panel voltage rise time is fast and reaches the last Voc quickly so it will come up and operate and not snooze at that point. The MX60 will abort the snooze cycle early if the Panel voltage goes a small amount above the last measured Voc. This is usually early in the morning when the Voc can be rising fairly quickly. Snoozing can also be initiated if the current into the battery did not reach the selectable cutoff current set point if in the < **Low cutoff** snooze mode.

< 90 % Voc	Snoozes if the panel voltage failed to rise to greater than 90 percent of the last measured Voc during a 1 second interval at the initial wakeup sweep, or at the **NewVoc** sampling in **U-Pick** MPPT mode. Typically, this < **90%** is preferred over the < **50%** mode.
< 50 % Voc	Snoozes if the panel voltage failed to rise to greater than 50 percent of the last measured Voc during a 1 second interval at the initial wakeup sweep, or at the **NewVoc** sampling in **U-Pick** MPPT mode.
< Lowcutoff	Snoozes if the initial sweep did not reach the Low Cutoff current. Useful in all modes but especially when the panel voltage is very close to the battery system voltage such as a 12 Volt battery and 12 volt array. This is the default snooze.
Disabled	No snoozing will occur. The MX60 may sleep and wakeup many times at dawn and dusk.

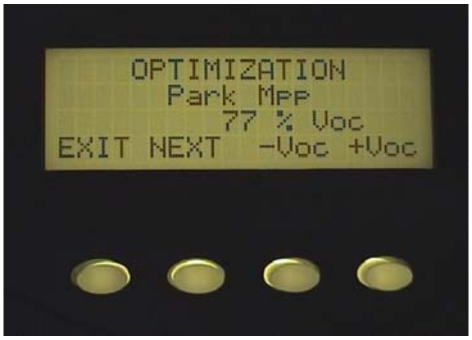
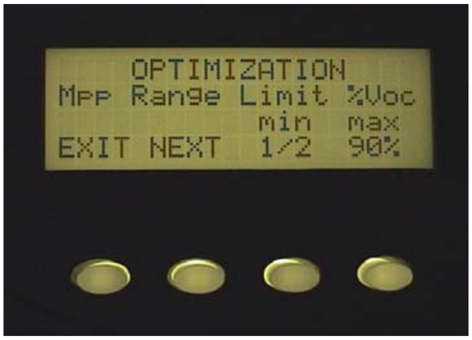

OPTIMIZATION
Park Mpp
77 % Voc

Figure 26 - Park Mpp

Park Mpp % (Voc): Picks the PV panel working voltage for U_Pick MPPT mode and other conditions where the MX60 operates at a fixed percentage of the last measured Open Circuit Voltage. This is not normally a critical exact value. An MPP of 77% of Voc is typically very close to the maximum power point of most panels.



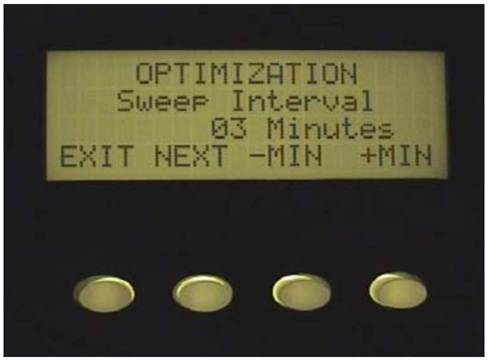
```
  OPTIMIZATION
Mpp Range Limit %Voc
           min  max
EXIT NEXT  1/2  90%
```

Typical PV Limit settings are 1/2 and 90%

Figure 27 – Mpp Range Limit adjustment

Mpp Range Limit % Voc (Auto Sweep mode only): These settings adjust the upper and lower allowable Max Power Point limits of the input range (PV usually), and are expressed as a percentage of the Open Circuit voltage (**Voc**). If a PV array has multiple power point "humps", then adjusting these setting will help keep the power point within sane MPP panel voltage limits. A solar panel normally has a **M**aximum **P**ower **P**oint voltage *greater* than 1/2 of its Voc, but *less* than 90% of Voc. If a mini-sweep finds a Maximum Power Point voltage *greate*r than the **max** voltage, or *less* than the **min** voltage, (**1/2** or **Ful**), the MX60 will revert to the **Park Mpp** instead (see park Mpp % above). 90% Voc is the default maximum limit, 1/2 is the default minimum value and will not normally need to be changed. If the input PV Open Circuit Voltage is greater than twice the battery voltage, setting the min range limit to 1/2 can speed up the initial wakeup sweep, because the input will not have to go all the way down to the battery voltage as it would if it were set to FUL. For example, a 24 Volt battery and 72 Volt nominal PV array would only have to sweep from 120 V down to 60 volts instead of to 24 Volts.

The **min** range limit setting may want to be set to **FUL** if something other than a PV array is connected to the input of the MX60, such as a Micro-Hydro generator, since these devices may have a Maximum Power Point voltage of less than 50% of their free-running voltage, but greater than the battery voltage. Remember, that whatever is connected to the input terminals of the MX60, the device **must not** present a voltage greater than the rating of the MX60 (**140V**) at *any* time. And, the MX60 will get much hotter if the Maximum **p**ower **p**oint of the device is greater than about 114 volts, which would be the maximum voltage it would see with a PV array with a Voc of 140 Volts. If the Mpp voltage is greater than this, and the output current (into the battery) is near 60 or 70 amps, the MX60 may get too hot and shut down.
The maximum adjustable Mpp range limits are 80%, 85%, 90%, and 99% of Voc.



```
  OPTIMIZATION
 Sweep Interval
      03 Minutes
EXIT NEXT -MIN  +MIN
```

Press **–MIN** to decrease minisweep interval minutes or **+MIN** to increase minutes

Figure 28 – Mini Sweep Interval

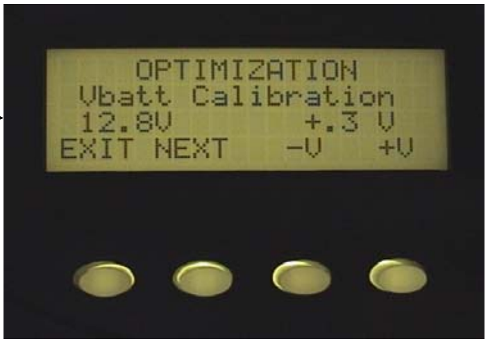
Sweep Interval: Selects how often the MX60 does an MPPT mini-sweep in Autosweep MPPT mode, or how often it acquires a New Voc in **U-pick** MPPT mode (see Optimization MPPT mode). When the main status display says **MPPT** or **EQ MPPT**, and when the MX60 is configured for **AutoSweep** MPPT mode, the input source will be periodically swept, (at this sweep interval), up and down in voltage slightly to stay running at the **M**aximum **P**ower **P**oint operating voltage. How far it sweeps up and down depends upon the output (battery) current at that time. If the Output current was greater than 25 Amps, the input voltage will be swept down and up until the output current drops by about 2 amps in each direction, or if output current is less than 25 Amps, but greater than 5 amps, it will look for a drop of about 1 Amp in each direction, then it will go back to MPPTing at the newly found Mpp voltage. If the output current was less than 5 amps, but greater than the Low Cutoff current setting (*see Optimization Low cutoff*), then the Mpp operating voltage will continue at the Park Mpp (*see Optimization Park Mpp %Voc*).

If a minisweep finds the Mpp outside of the Mpp range limits, the MX60 will also run the PV input Mpp at the park Mpp setting. To avoid this, if necessary, just disable minisweeps by setting the sweep interval to 0 minutes. The MX60 will fully (or 1/2) sweep every hour, if enabled in LOG2 (*see LOG2 setting Auto Re-Start*)

Adjustable from 0 minutes, (never minisweep), to every 15 minutes. Press –**MIN** or **+MIN** to change time interval minutes settings.

Minisweeps are different than the initial wakeup sweep. The initial wakeup sweep will take the PV input, (or whatever is connected to the MX60 input terminals), and drag it (sweep it) it all the way down to either the battery voltage, if Mpp Range is set to **FUL**, or it will sweep the input down to 1 / 2 of the Voc if set for **1/2** minimum Mpp Range Limit (*see Optimization Mpp Range Limit %Voc*). The initial wakeup sweep looks at the entire V/I curve of the input device and sets the initial operating point. The minisweep looks around that point, but if the output current continues to rise during the minisweep, the MX60 will keep going until the output starts dropping in current, and therefore, output power. The sweep and MPPT algorithm of the MX60 also works very well at finding the **M**ax **P**ower **P**oint of partially shaded PV arrays, which is found in a lot (if not most) installed systems.

The present Vbatt meter reading is displayed here for convenience



```
 OPTIMIZATION
Vbatt Calibration
 12.8V      +.3 V
EXIT NEXT   -V   +V
```

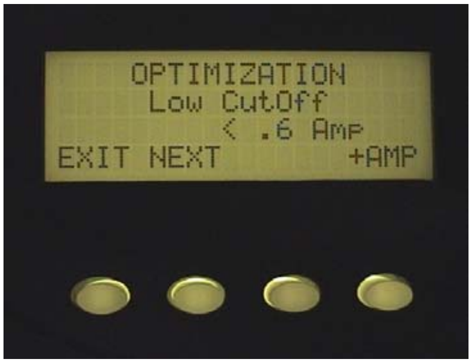
Adds or subtracts an offset to the MX60 output volt meter

Figure 29 - Vbatt Calibration Offset

Vbatt Calibration (Output/Battery Voltage display Offset): Adjusts the battery voltage reading and battery voltage feedback of the MX60. Adjustable between plus ½ volt and minus ½ volt, this setting is used to improve the accuracy of the MX60's battery voltage readings. For in field calibration, a good voltmeter will be handy.

Remember that the MX60 voltage reading is taken near the wire terminal block, and when a significant amount of current is flowing into the battery, the voltage drop in the wires may show a slightly different voltage at the battery terminals than at the MX60 terminals because of the voltage drop. The MX60s Input/Output terminal block has little holes behind the screws for inserting meter probes. It is recommended that you use these instead of the top of the screws if possible, because the screw heads do not always give the best connection for reading voltage.

Also, check the Battery temperature compensation voltages if voltages are much different than you expect from the charger setup Absorb and Float voltage settings. (*see Miscellaneous 1 screen*)



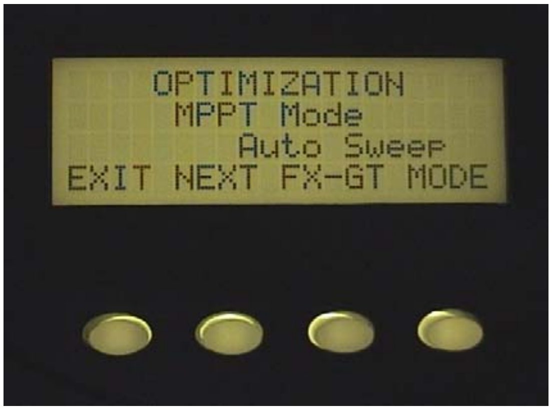
OPTIMIZATION
Low CutOff
< .6 Amp
EXIT NEXT +AMP

Lowest charging current in MPPT mode to determine whether to sleep or snooze.

Figure 30 - Low Cutoff Amps

Low Cutoff Amps: Sets the battery chargers lowest current limit that the MX60 will allow to charge in MPPT mode before stopping and going back to sleep. If the battery charge current goes below this setting for a time, the MX60 will go back to sleep. Adjustable from 2 tenths of an Amp to 1 Amp. 6 tenths Amp is the default Low Cutoff current. If you find your MX60 is having a hard time going to sleep, you may try raising this value.

The Low Cutoff current setting is also used in the Auto Sweep mode during the initial full panel wakeup sweep to determine of it should snooze for 5 minutes. If the **< Low Cutoff** snooze mode is selected, and if the current during that sweep did not reach the Low Cutoff current setting, the MX60 will snooze.



OPTIMIZATION
MPPT Mode
Auto Sweep
EXIT NEXT FX-GT MODE

Selects from the two different MPPT operating modes of the MX60

Select **FX-GT** mode if you have a **GridTied** FX, MATE and HUB connected to the MX60. Otherwise, select **non-GT**

Figure 31 - MPPT Mode

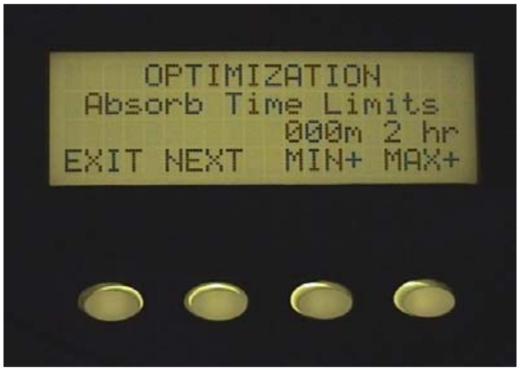
MPPT Mode Select (Auto or U_Pick)

Selects the basic MPPT mode of the MX60.

Auto Sweep MPPT mode (default and preferred MPPT operating mode) does a full (or 1/2) input (PV) sweep (*see minisweep interval*) upon wakeup and then does mini Auto Sweeps from that point on at the selected sweep time interval. U-Pick % (Voc) MPPT mode operates the PV or input Mpp at a selectable percentage of the open circuit panel voltage (*see Optimization Park Mpp %Voc*) and acquires a **New Voc** value every Sweep Interval. The Mpp operating point is derived from the Park MPP setting in U Pick MPPT mode. If minisweep interval is set to 0 minutes, a NewVoc may be acquired once per hour depending on the AutoReStart setting (see LOG2 Auto ReStart) This mode is an alternative to the Auto Sweep mode and may also be useful for other applications such as fuel cells.

If you are using a **G**rid **T**ied FX inverter, MATE and HUB, set Button 3 so **FX-GT** is displayed. Otherwise select **non-GT**. Otherwise, if using a non-compatible MATE, the MX60 may not work properly. If the MX60 does not seem to be charging, and a MATE is connected, check this setting.

Reference paper: "A Simplified Maximal Power Controller For Terrestrial Photovoltaic Arrays"
J. J. Schoeman and J. D. Van Wyk PESC 0275-9306/82/0000-0361 1982 IEEE



OPTIMIZATION
Absorb Time Limits
000m 2 hr

Figure 32 - Max Absorb Time

Absorb Time Limits and Charge Timer: Sets the minimum and maximum amount of time the MX60 is allowed to stay in the Absorb charge stage. MAXimum is adjustable from 1 to 4 hours. MINimum Absorb time is adjustable from 0 minutes up to the maximum absorb time limit… *minus* 10 minutes. For example, if maximum Absorb time is set for 2 hours, then the minimum Absorb time could be adjusted up to 110 minutes.

When a Bulk charge cycle starts first thing in the morning, the charge timer, (*see* ChgT *miscellaneous 1 screen*) will be preset with the minimum Absorb time limit (usually 000). As the MX60 is Bulking/MPPTing, and trying to get the battery voltage up to the Bulk termination voltage, (the Absorb voltage), this counter will be counting UP in minutes. When the timer reaches the Maximum absorb time, it will stop there. The charger will continue to put current into the battery and when the Absorb voltage is reached, it will start to count down towards zero. When the charge time reaches zero, then the MX60 will go to the float stage. At this time, the MX60 status display will show **Bat Full,** (battery Full), until the battery voltage drops below the float voltage set point. Then, the status display will show Float and try to keep the battery voltage at the Float set point voltage. If, when in the float stage, the system cannot keep the battery voltage at the float voltage, the MX60 will go back to MPPTing and try to reach that float voltage again. (No timers are involved in the Float stage)

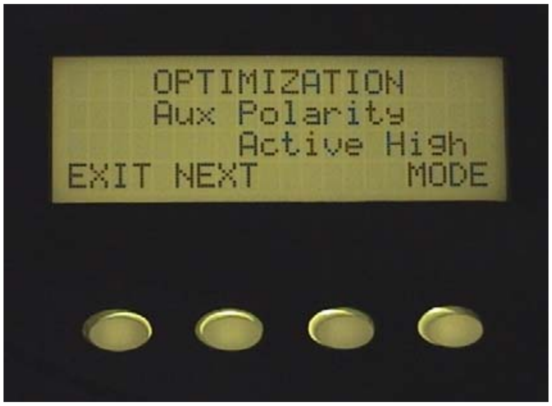
If, during the Absorb cycle when the charge timer is counting down, the system is unable to keep the battery voltage at the Absorb voltage set point, the MX60 will return to MPPT and the charge timer will continue counting up towards the Max Absorb time again. This up and down counting will continue until the charge timer counts down to zero.

Reasons for a system not being able to keep the battery at the Absorb or Float voltage might be because of too many DC loads being turned on or clouds.

Another way for the MX60 to complete an Absorb cycle before the charge timer (ChgT) reaches zero, is for the Absorb Ending Amps to be set to something other than the default of 00 Amps (*see miscellaneous 3 screen*). If the Absorb Ending amps setting is set to, for example, 12 amps, then, when the battery current dropped to 11.9 amps, the Absorb cycle would end, the charge timer would be reset to zero, and the MX60 would continue in the float stage. The next Bulk/Absorb cycle will not start until either, the next morning, a 24/25 hour period if the sun did not set, (*see LOG2 screen*), a **Force Bulk** being initiated, (*see miscellaneous 2 screen*), or, a **Re-Bulk** occurs because of the battery voltage dropping below the Re-Bulk voltage setting for 90 seconds (*see miscellaneous 3 screen*).

Some batteries reach the Absorb voltage very quickly… Too quickly in fact, for the battery to get a good Bulk/Absorb cycle in. This is why you might want to change the minimum absorb time to something other than zero. The Charge timer would normally rack up some time in the wee twilight hours of the morning because the current is so low, but if the current rises too quickly, this is a good way to ensure a minimum time in the Absorb stage.

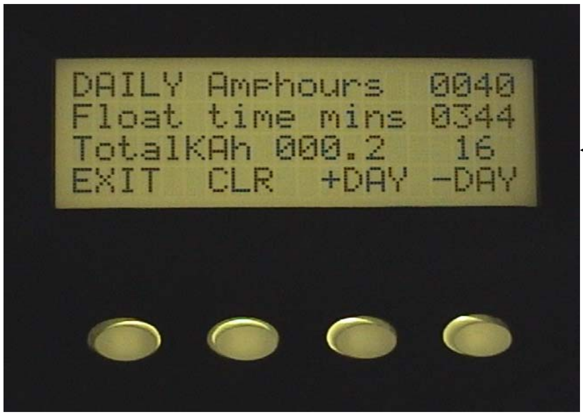
You can also disable the Absorb cycle altogether by setting the minimum and maximum absorb time both to zero.



```
  OPTIMIZATION
  Aux Polarity
     Active High
EXIT NEXT      MODE
```

Figure 33 - AUX POLARITY

Aux Polarity: Selects whether the Auxiliary Output is “Active High” (12 Volts applied to terminals when the Aux function’s condition is True), or ”Active Low”, (no voltage is applied to the terminals when the function’s condition is true.) Either way, a display of “On” in the status screen means that 12 Volts is being applied to the Aux Output terminals. Active High is the default state of the Aux polarity.



```
DAILY Amphours  0040
Float time mins 0344
TotalKAh 000.2   16
EXIT  CLR  +DAY -DAY
```

Statistics for the last 64 days and the MX60’s total energy/amphour production are shown in the Logging screen

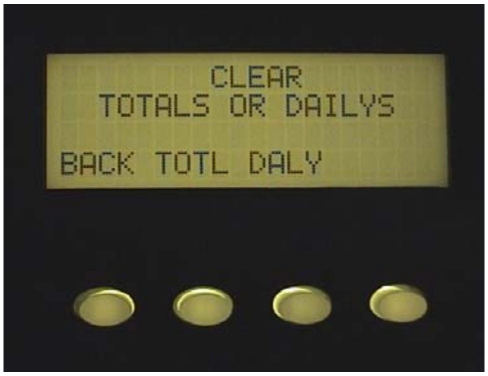
The DAY number shows how many days ago the data is for

Figure 34 - The main logging screen

Logging: This screen shows the Amp Hours (or kilo-Watt Hours and the time (in minutes) that the MX60 spent floating the batteries for each of the last 64 days. Whether AmpHours or kWh are displayed, depends on the display setting in the **main status** screen. Day 01 is yesterday. Pressing –**DAY** goes back one day and pressing +**DAY** goes forward one day. If starting on Day 01 and +**DAY** is pressed, the value from 64 days ago is presented. Total Kilo Amp Hours or Kilo Watt Hours accumulates daily values and continue beyond 64 days of data. There will be least significant digit data in the Totalized values that may not be displayed until enough data accumulates.

Today’s Float time can be found in the **LOG2** screens.

Pressing **CLR** takes you to the Clear Daily and Totals menu and **EXIT** takes you back to the main status screen.

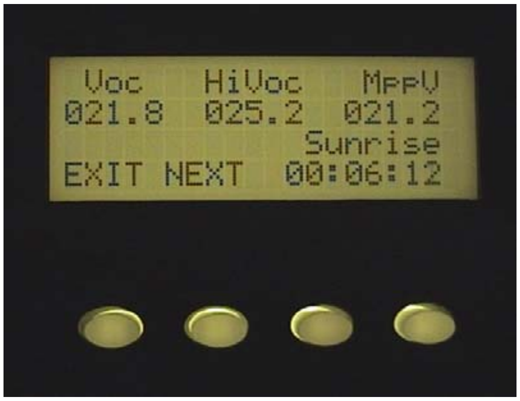


Pressing and holding the TOTL or DALY button will prompt you to erase those total accumulated values

Figure 35 - Clear Total logged values

CLR TOTALS: Pressing and holding **TOTL** for a few seconds will bring up the *Are you sure?* Screen, prompting you to clear the Total accumulated kWh and Kilo-AmpHours statistical values in the MX60. Pressing and holding **DALY** for a few seconds will bring up the *Are you sure?* Screen for clearing all of the Daily logged values. After **Yes** is confirmed, the values will be cleared. It may take a few seconds for all 64 daily values to be cleared before the confirmation screen goes away. Pressing **BACK** goes back to the Logging screen.

Sunrise shows how long ago the MX60 woke up for the first time today



Buttons 3 and 4 toggle 24/25 hour save mode and Auto Re-Start modes

Figure 36 - The LOG2 screen

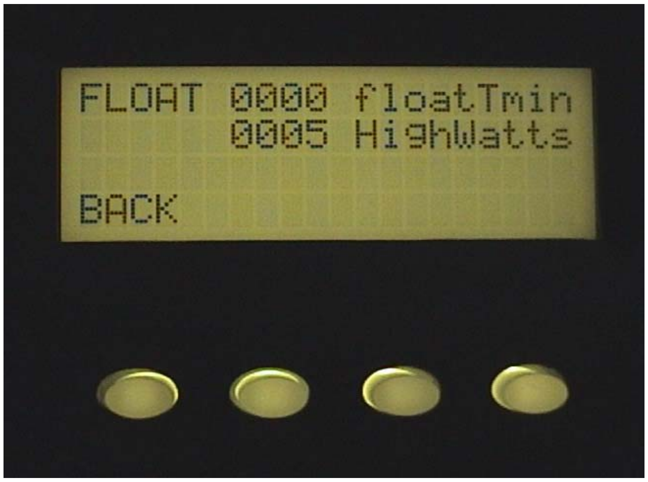
LOG2 Screen: The LOG2 screen shows the last measured open circuit panel voltage (Voc), the highest Voc seen by this MX60, the present **M**aximum **P**ower **P**oint **V**oltage being used in the MPPT stage, and the amount of time since the daily and total logged values were updated (**Sunrise**). Sunrise actually shows the last time the daily logging values (*see Logging*) were updated and cleared from the main status screen. This normally happens when the sun first comes up, (first wakeup of the day), and after at least 3 hours of sleeping. After 3 hours of sleeping, the MX60 will display Zzzz… This means that the next wakeup will cause all of the daily KiloWAttHour, AmpHour statistics, and Float Time to be logged and/or accumulated and are shown in the Logging screen.

There may be situations where the sun never sets, or Input (PV) never goes away, like in parts of Alaska, or if Micro-Hydro or a Fuel Cell is connected to the MX60s input. In this case, the MX60 will create its own sunrise at either 24 or 25 hours automatically. Pressing and holding down button 3 for a few seconds will toggle the value between 24 and 25 hours. 25 hour transfer is the default so that sunrise has the first chance at transferring and restarting the sunrise clock counter in the MX60 since days can actually be longer than 24 hours. When using input sources where you know it is going to require the automatic logging transfer, you will probably want to set this to 24 Hours.

Holding button 4 down for a few seconds, will select the MX60s Auto ReStart mode. There are 3 ReStart modes. 0, 1, and 2. AutoStart mode 2 is the default. When the new mode has been changed, the screen will display that number in the center of the LCD until you release button 4.

Mode 0 means that the MX60s Auto ReStart mode is disabled.
Mode 1 means that **once per hour**, when the MX60 is showing MPPT and **M**aximum **P**ower **P**oint Tracking, it will briefly Restart from sleep and initiate a full panel sweep. This will not reset any Counters or charging stages or statistics. Only the Auto ReStart counter will restart.
Mode 2 is the same as mode one, where MPPT Auto ReStarts once per hour, but with the addition that In Absorb and Float, the MX60 will AutoReStart from sleep once every **90 minutes**.
Minisweeps at the sweep interval will still happen on time in either of the modes.
In either mode 1 or mode 2, the MX60 will display "**AutoStart**" on the main status display for a moment. These Auto ReStarts are mainly so that the MX60 can re-calibrate its current sensor if necessary, and can also help eliminate any possibility of software hangs. It is recommended to keep the MX60 in mode 2 (default). An example of when you might want to pick mode 0 is if you have a micro hydro connected, and do not want the generator to spin up once an hour at night and keep you awake. No sense losing sleep over alternative energy.

Pressing **NEXT** will take you to a secondary LOG2 screen which shows the basic charging state of the MX60 (BULK, FLOAT, EQ), FLOAT time in minutes, and the daily maximum (peak, HighWatts) wattage seen by the MX60 during the day. HighWatts are also cleared once a day upon the first wakeup as well as the MX60 re-triggering a Bulk charge state.



```
FLOAT 0000 floatTmin
      0005 HighWatts

BACK
```

Figure 37 - The secondary LOG2 screen

Secondary LOG2 Screen:

Figure 37 show the secondary LOG screen. The upper left corner shows what charge stage the MX60 is in. It may show Bulk, Absorb, EQ (with elapsed time in Hours and minutes), or Float. If the MX60s main status screen is displaying **MPPT**, this is one way to see what stage, (Bulk or Float) it is actually in. floatTmin shows todays time (in minutes) spent in the Float stage.

This also includes time when the MX60 has gone back to MPPT but still looking to reach the float voltage. It will not accumulate Float time at night and when it is sleeping.

HighWatts show the daily peak Watts seen by the MX60. When first powering up the MX60, this value will show the Highest Wattage EVER seen by the MX60. This number is reset to zero every sunrise just like all of the other statistics.

Basic MX60 Block Diagram:

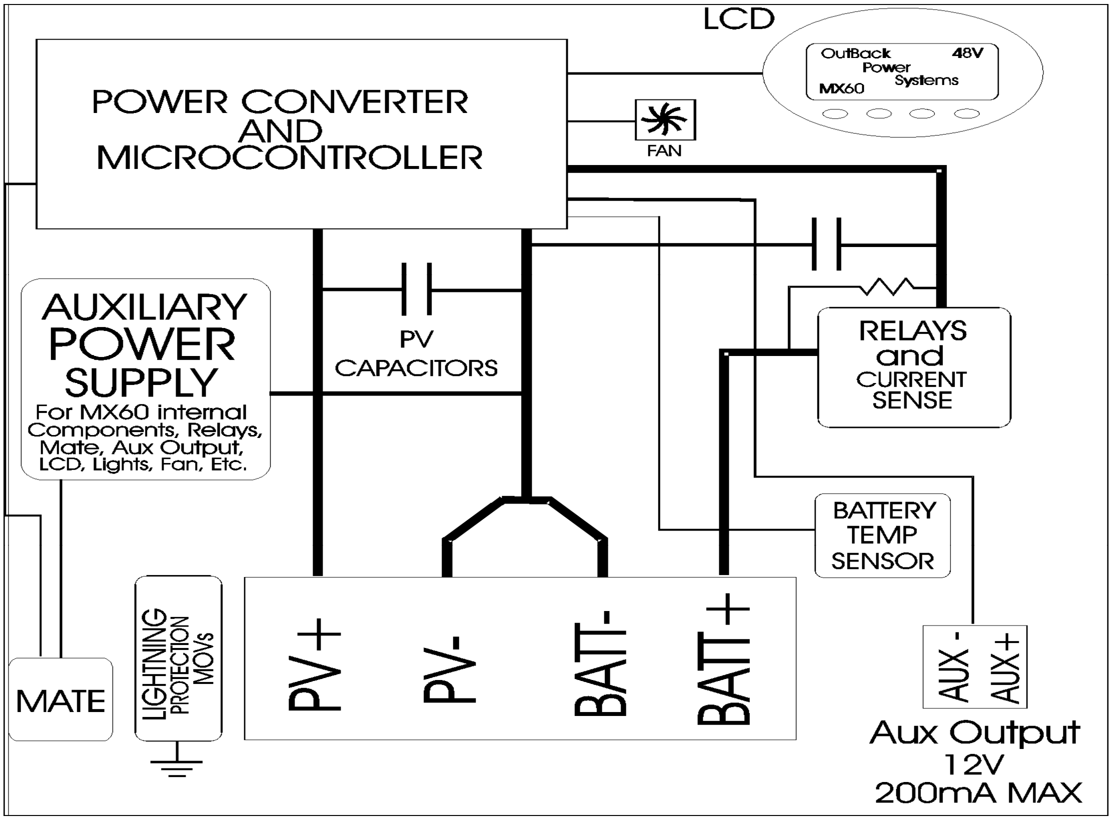

LCD
OutBack Power Systems
48V
MX60
POWER CONVERTER AND MICROCONTROLLER
FAN
AUXILIARY POWER SUPPLY
For MX60 internal Components, Relays, Mate, Aux Output, LCD, Lights, Fan, Etc.
PV CAPACITORS
RELAYS and CURRENT SENSE
BATTERY TEMP SENSOR
MATE
LIGHTNING PROTECTION MOVs
PV+
PV-
BATT-
BATT+
AUX -
AUX+
Aux Output
12V
200mA MAX

Figure 38 - MX60 Basic Block Diagram

Application Notes

Grid intertie applications:

When using the MX60 with grid intertie inverters and selling electricity back to the grid, keep the MX60 float voltage above the voltage at which the inverter will be selling back. This ensures that the MX60 is always trying to put out more voltage than the inverter is trying to drag the battery voltage down to and to keep the current flowing. 0.5 Volts difference for 24V battery systems, or 1.0 volt difference for 48V battery systems is a good rule of thumb.

Diversion using hydro or wind power:

When the wind generator or hydro generator is connected to the battery terminals as an external DC source, keep the MX60s diversion voltage slightly above the MX60s Absorb and Float voltages so the MX60 can do it's job, but the wind and/or hydro DC sources stay slightly out of the way voltage wise.

Positive grounded systems:

Telcom applications frequently require a positive grounded system. Just remember that the MX60 switches the POSITIVE PV and battery leads and needs to keep those separate. It is suggested to ground ONLY the battery positive lead in this case (if code allows it). Do not connect the MX60's battery plus to the PV plus input while the MX60 is running.

Battery temperature compensation with other slopes:

The MX60 uses a 5mV per degree C per cell (2V) Compensation slope required by UL if you run the MX60 at or near the default system voltages. If you need to use slopes other than this, you may be able to pick a system voltage other than the one you are running, and change the charger Absorb and Float voltage settings up or down from that default setting to achieve a more or less aggressive slope. If going lower in voltage, pull down the Float voltage first, since the Absorb voltage will not be settable below the current Float voltage setting. If going higher in voltage, pull up the Absorb setting first, before bringing up the Float voltage above the current settings. Here is a table of MX60 compensation based on system voltage for reference:

12V system	-30mV/degree C
24V system	-60mV/degree C
36V system	-90mV/degree C
48V system	-120mV/degree C
60V system	-150mV/degree C

Grid Tie voltage settings:

When using the MX60 with an inverter for grid tie, the main thing to remember is to set the Grid Tie inverter for a LOWER voltage than either the MX60s absorb or Float voltage settings. This way, the MX60 will always be in MPPT mode and putting out as much current as possible. The inverter doing the selling will drag down the battery voltage so MPPT will happen. A couple volts of difference for a 48 Volt battery system is a good starting point.

Using the MX60 with an **FX Grid Tied** inverter with MATE/HUB communications will work best of course. If using it in this way, make sure to set the communications to **FX-GT** mode in the **MPPT MODE** Optimization setup screen.

Beeping noises and how to turn them off:

If the Mx60 is beeping and making funny noises, it is most likely in "Extended Play" mode. This is normal and occurs when the solar panels in the array are hot and their Maximum Power Point is very near to the voltage of the batteries or briefly when the initial sweep has gotten to the battery voltage. If it is too noisy, this feature can be disabled... From the Main Menu of Menus screen, press and hold EXIT and while the software version is being displayed, press and hold button 3 for a couple of seconds until "X Off" is displayed. Doing this again will enable Extended play again. Extended play mode is meant to optimize performance in hot panel conditions and is not absolutely necessary for the MX60 to work. It won't make these noises at night in a PV system if mounted near a bedroom window. IF the PV array voltage is much higher than the battery voltage and beeps when the initial PV sweep meets the battery voltage, you may want to reduce sweep time by going to the Optimize screen, then in the SLOW menu of the Max Absorb time menu, pick the ½ sweep mode instead of Full sweep.

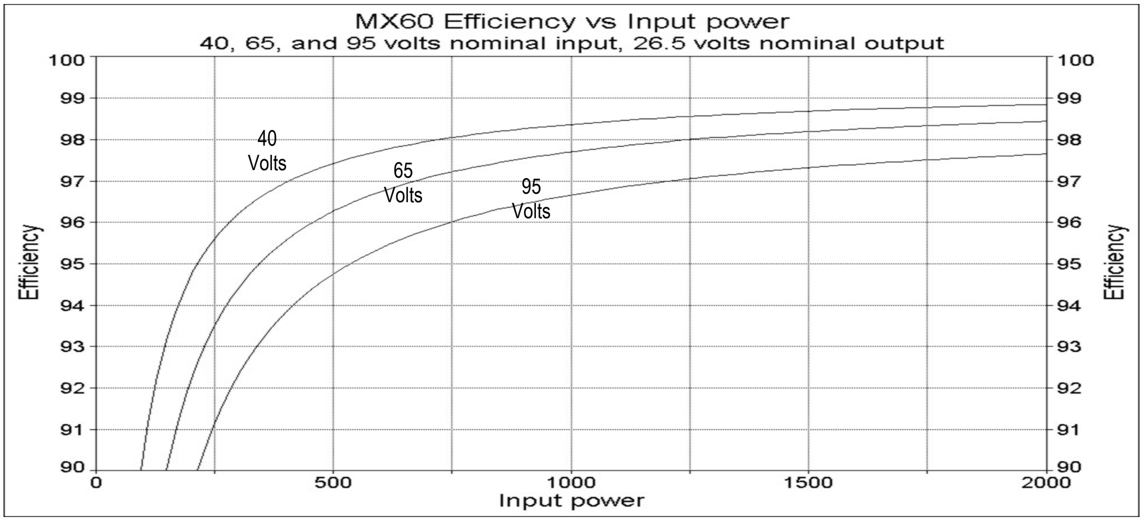
CALLING THE FACTORY FOR MX60 ASSISTANCE:

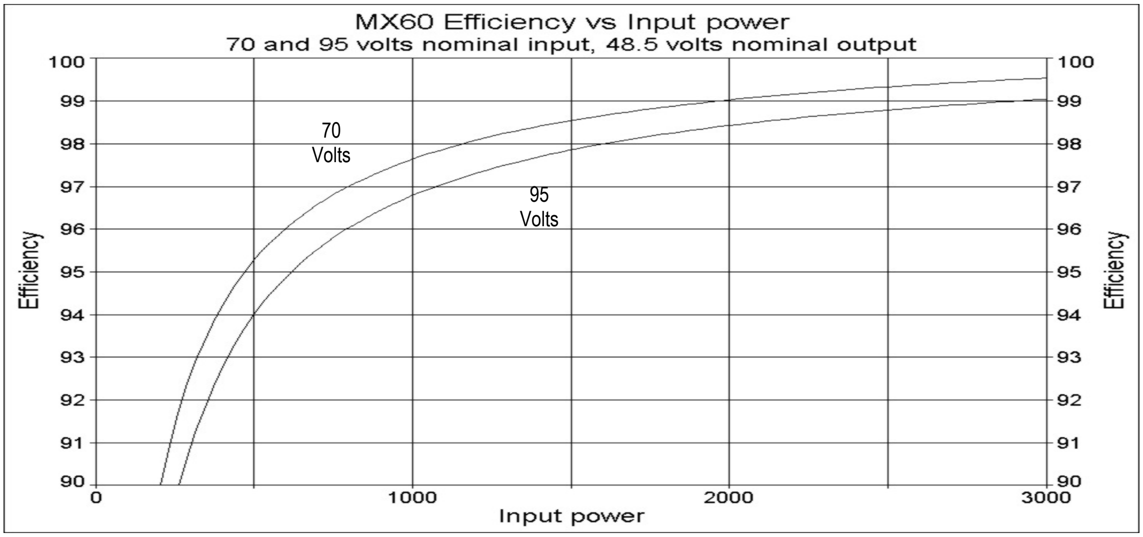
When calling OutBack Power for product assistance, please have the following information ready if possible:

- MX60 Serial number and software version. The software version can be viewed by exiting the Status screen to the menu screen, and then exiting the menu screen back to the Status screen and holding down the EXIT key.
- The nominal PV array and battery voltage.
- The PV array operating voltage and battery current and any Status screen operating mode displays, such as MPPT, Absorb or Float.

SPECIFICATIONS:

Output Current Rating:	60 Amps
Default Battery System Voltage:	12, 24, 36, 48 or 60VDC (adjustable)
PV open circuit voltage:	120VDC Maximum (ETL Rating for UL1741 Standard)
Standby power consumption:	Less than 1 watt typical
Charging regulation methods:	Five stage: Bulk, Absorption, Silent (Battery Full), Float , Equalization
Voltage regulation set points:	13-80VDC
Temperature compensation:	With optional sensor 5 millivolts per degree C per 2V cell
Voltage step down capability:	Can down-convert from any PV array voltage within PV VOC limits of 120V to any battery system voltage. Examples: 48V array to 24V; 60V array to 48V
Digital Display:	4 line 20 character per line backlit LCD display
Remote Interface:	RJ45 modular connector Cat 5 cable 8 wire
Operating Temperature Range:	-40˚ to 60˚C de-rated above 25˚C
Environmental Rating:	Indoor type 1
Conduit knockouts:	Two 1/2-3/4" on the back; one 3/4-1" on each side; two 3/4-1" on the bottom
Warranty:	Two years parts and labor, optional extended warranty available
Dimensions:	Unit: 14.5"H x 5.75"W x 5.75"D Boxed: 17.8"H x 10W x 7"D
Weight:	Unit 12 pounds Boxed 15 pounds


MX60 Efficiency vs Input power
40, 65, and 95 volts nominal input, 26.5 volts nominal output
Efficiency
Input power
40 Volts
65 Volts
95 Volts
100
99
98
97
96
95
94
93
92
91
90
0
500
1000
1500
2000


MX60 Efficiency vs Input power
70 and 95 volts nominal input, 48.5 volts nominal output
Efficiency
Input power
70 Volts
95 Volts
100
99
98
97
96
95
94
93
92
91
90
0
1000
2000
3000

OutBack Power Systems
Two Year Limited Warranty

OutBack Power Systems Inc. warrants that the products it manufacturers will be free from defects in materials and workmanship for a period of two (2) years subject to the conditions set forth below.

The limited warranty is extended to the original user and is transferable. The limited warranty term begins on the date of invoice to the original user of the product. The limited warranty does not apply to any product or part thereof damaged by a) alteration or disassembly, b) accident or abuse, c) corrosion, d) lightning, e) reverse polarity, f) repair or service provided by an unauthorized repair facility, g) operation or installation contrary to instructions pertaining to the product. OutBack Power Systems' liability for any defective product or any part thereof shall be limited to the repair or replacement of the product, at OutBack Power Systems' discretion. OutBack Power Systems does not warrant or guarantee the workmanship performed by any person or firm installing its products.

THIS LIMITED WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS THAT VARY FROM STATE TO STATE (OR JURISDICTION TO JURISDICTION). OUTBACK POWER SYSTEMS' RESPONSIBILITY FOR MALFUNCTIONS AND DEFECTS IN HARDWARE IS LIMITED TO REPAIR AND REPLACEMENT AS SET FORTH IN THIS LIMITED WARRANTY STATEMENT. ALL EXPRESS AND IMPLIED WARRANTIES FOR THE PRODUCT, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF AND CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE LIMITED WARRANTY PERIOD SET FORTH ABOVE AND NO WARRANTIES, WHETHER EXPRESS OR IMPLIED, WILL APPLY AFTER SUCH PERIOD. SOME STATES (OR JURISDICTIONS) DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

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During the two year period beginning on the invoice date, OutBack Power Systems will repair or replace products covered under this limited warranty that are returned to OutBack Power Systems' facility or to an OutBack Power Systems authorized repair facility, or that are repaired on site by an OutBack Power Systems authorized repair technician. To request limited warranty service, you must contact OutBack Power Systems at 360-435-6030 within the limited warranty period. If limited warranty service is required, OutBack Power Systems will issue a Return Material Authorization (RMA) Number. Mark the outside of the package with the RMA number and include a copy of the purchase invoice in the package. You must ship the products back to OutBack Power Systems in their original or equivalent packaging, prepay shipping charges, and insure the shipment or accept the risk of loss or damage during shipment. OutBack Power Systems will ship the repaired or replacement products to you freight prepaid if you use an address in the continental United States, where applicable. Shipments to other locations will be made freight collect.

REGISTER YOUR PRODUCTS

Your purchase of an OutBack Power Systems product is an important investment. Registering your products will help us maintain the standard of excellence you expect from us in terms of performance, quality and reliability.

Please take a moment to register and provide us with some important information.

Name: ____
Address: ____
City, State, Zip Code: ____
Country: ____
Telephone Number: ____
E-mail: ____

Sold by: ____
Installer: ____
Purchase Date: ____

Model Number:_MX60____
Serial Number: ____

Check all that apply:

- ____ **Off-Grid Installation**
- ____ **Grid-Tie Installation**
- ____ **Residential Installation**
- ____ **Commercial Installation**

This registration form can be removed from the MX60 Manual, folded, and mailed using the address on the reverse side.

EXTENDED WARRANTYAPPLICATION

OutBack Power Systems offers an optional three year extension to the standard two year limited warranty. Purchase of extended warranty coverage is available on products listed below provided conditions shown are met. Extended warranty coverage must be purchased within 90 days of the original sale of the product covered.

PRODUCT	**REQUIRED SURGE PROTECTION**	**EXTENDED WARRANTY COST**
FX2024	AC Input; AC Output, DC Input	$300.00
FX2048	AC Input; AC Output, DC Input	$300.00
MX60	DC Input; DC Output	$100.00
MATE	NA	$50.00
HUB 4	NA	$35.00
HUB 10	NA	$50.00

Products Covered	**Serial Number**	**Extended Warranty Cost**
		Total

Send check or money order payable to OutBack Power Systems. Include a completed copy of this application and send to:

OutBack Power Systems
Extended Warranty Program
19009 62nd Ave NE
Arlington WA 98223 USA

FROM

Postage
Required

OutBack Power Systems Inc.
19009 62nd Ave NE
Arlington, WA 98223

OutBack Power Systems

MATE

System Controller and Display

Installation and User Manual for the OutBack MATE and MATE2

OutBack
Power Systems
DC↔AC 1.9kW
AC Load
No ACIN
Battery 24.4V
AC IN
INV

Please check our website at www.outbackpower.com for the latest product information

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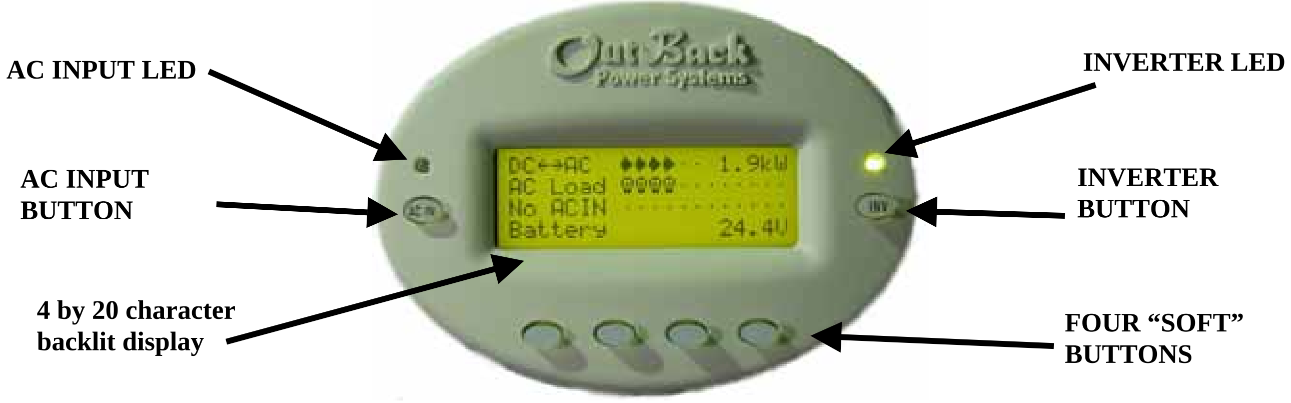
1.0 Introduction

The OutBack MATE is a complete system controller and display for both the OutBack FX inverter/charger and the MX60 PV MPPT charge controller. It provides a display of the operation as well as allows for control and adjustment of the product setpoints. The OutBack MATE also coordinates the operation of the entire system to maximize the performance and to prevent multiple products from conflicting.

Through the use of an OutBack HUB communication manager a single OutBack MATE is able to connect to multiple FX inverter/chargers, MX60 PV MPPT charge controllers and any other OutBack products offered in the future. A maximum of ten OutBack products will be able to be connected to a single MATE via a HUB using CAT 5 type Ethernet cabling with 8 wire RJ45 modular connectors.

1.1 Features



LCD Display

Four line, 80 character backlit LCD display with alphanumeric and graphic displays

Control Keypad

Six backlit silicone membrane keys – dedicated Inverter and AC input "hot" keys for control & 4 soft keys

Status Indicators

Two LED indicators: *Green = Inverter status* *Yellow = AC Input status*

Communication Protocol

Proprietary OutBack Multi-drop network using the OutBack HUB.

Interconnecting Cable

Standard CAT 5 PC network cable with RJ45 modular connectors / wired as non-crossover

Maximum Cable Length

The maximum distance that has been tested is 1000 feet of cable in an office / commercial building with success.

PC computer interface

RS232 Opto-Isolated DB9 serial communication port

1.2 Installation

The OutBack MATE is designed for surface mounting in an Indoor location. Keep the MATE out of direct sunlight to make the display easier to view.

The cabling from the MATE to the FX inverter/charger, MX60 PV MPPT charge controller or HUB is standard CAT5 type computer cable. Standard Ethernet CAT5 cable, can be found at any home improvement or computer store. Consult your local inspector for specific installation requirements. The current and voltage in the communication cable is limited to less than 30 volts DC and is considered to be a "limited energy circuit". No conduit should be required. Either CAT5 or CAT5e cable can be used. The MATE is shipped with 50' of cable with the correct RJ45 connectors already installed. Longer or shorter cables can be purchased pre-made or custom length cable can be made on site. Follow the cable manufactures' instructions when choosing connectors and crimping tools.

NOTE: The maximum tested cable length from the MATE to an OutBack product is 1000 feet (300 meters). This distance can vary depending on cable routing and location. MATE cable that is run in a 'noisy' environment (ex. MATE cable run in conduit with AC wiring) will suffer from signal degradation, impacting the maximum length the cable can be run without incurring transmission errors.

The MATE should be wall mounted at just below the eye level of the typical user. No wiring box is required, although a standard 2 gang wiring box mounted in the horizontal position (as opposed to the typical vertical position of a light switch) can be used for the cable entry. By bending the wiring at a 90 degree angle just after the connector, no wiring will be visible. The RS-232 port for the PC computer is accessible from the bottom of the MATE when it is wall mounted. It also can be removed from the wall for connection of the serial cable.

To install the MATE, unsnap the cover from the back of the MATE. There are four holes in this plate for mounting screws. After installing the mounting plate on the wall, connect the cable to the jack on the back of the circuit board. Snap the MATE onto the mounting plate and push any excess cable back into the wall.

2.0 Basic Operation

2.1 Power Up

A soon as the MATE cable is plugged into a powered OutBack product, the MATE will power-up and display several information screens. After a greeting and copyright screen appears, the next screen displayed has the MATE Code and Screen Revisions (see below).

```
       Version
Code a.aa
Serial #xxxxxxxx
Screen EE b.bb
```

The MATE's operation and features are dictated by the code version. The serial number displayed matches the bar coded sticker on the MATE's main PCB. This can be viewed by removing the MATE's back cover. The Screen EE version refers to the menu system currently loaded in the MATE. All of the version and serial numbers should be referred to when contacting OutBack with MATE questions.

For an explanation of the differing code versions, see the ***MATE firmware revisions*** topic under ***MATE Release Notes*** on the ***OutBack Power Systems User Forum*** found at: http://www.outbackpower.com/cgi-bin/Forum/ultimatebb.cgi .

After the Version screen the MATE will display a connected devices screen (see below). If the MATE does not find the connected device, refer to the section 7.0 Troubleshooting.

MATE found an FX

```
  Searching
 for Devices
  FX Found
```

MATE found a MX

```
  Searching
 for Devices
  MX Found
```

MATE found no OutBack Product

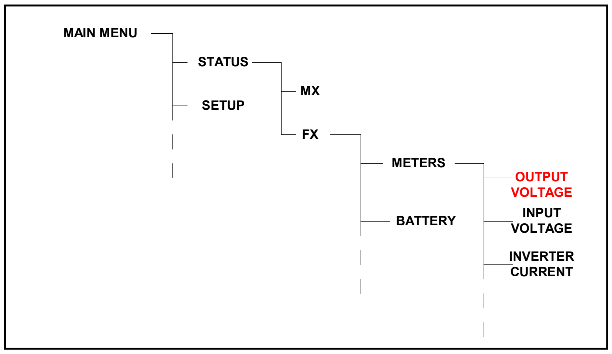
```
    Searching
   for Devices
No Devices Found
```

2.2 Navigation

This section of the manual will cover how to use the buttons on the MATE to navigate the menus.

NOTE: The menu system displayed on the MATE will vary depending on the software version that the MATE was programmed with at the time of manufacturing or during its last software upgrade.

2.2.1 Menu Structure



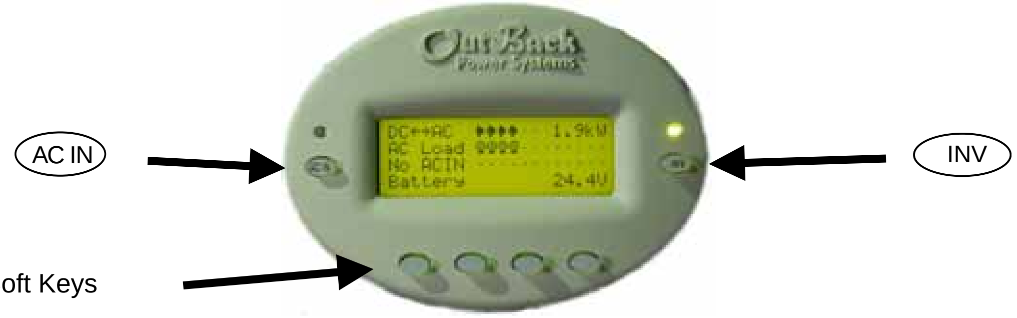
The OutBack MATE uses a branching menu structure to display various OutBack products operation modes and status. The menus are divided by product type and are categorized by type of settings or information is being displayed.

An example of the menu structure is shown to the right. All the screens that show AC meters are grouped together in one menu tree allowing the user to find the required meter with a minimum of button presses.

The top line of the MATE display will show the 'path' to the current menu; in this example it is STATUS/FX/METERS.

```
STATUS/FX/METERS---------
output                122 vac
voltage
DOWN   UP   TOP   PORT
```

2.2.2 Mate Buttons



The MATE uses a six button user interface to navigate the menus and to change setpoints of various OutBack products.

Two buttons are dedicated for the FX inverters and are labeled **ACIN** and **INV**. These buttons are special in that they can be pressed at any time anywhere in the MATE menu structure, and they take you to the same screens. For this reason they are referred to as 'hot' keys. Many common functions that need to be accessed often are found under the **ACIN** and **INV** button.

The four lower buttons under the LCD are called 'soft' keys and are used for navigating around the menus and changing values. Each 'soft' key has various functions dependent on the label directly above it on the lower line of the LCD.

NOTE: The lower line on the MATE is almost exclusively used for labels to the four soft keys below. This manual will denote soft key button presses as **<BUTTON>**, where **BUTTON** corresponds with the label displayed on the screen directly above the soft key.

2.2.3 ‘SOFT’ Keys

The four buttons under the LCD are referred to as the ‘soft’ keys. Their operation is dependent on what their label says. The label is the word on the bottom line of the LCD directly above the button.

Soft keys used to navigate the menus are commonly labeled **<UP>**, **<DOWN>**, **<NEXT>**, **<BACK>**, or **<TOP>**.

Soft keys that change settings are labeled either with the change they will make, such as : **<OFF>**, **<AUTO>**, and **<ON>**, or if there are more then a couple values that the setting can be changed to, **<INC>** and **<DEC>** are used to mean *inc*rease and *dec*rease, respectively.

```
SETUP/FX/INPUT---P00
ac transfer     GRID
control
DOWN  GRID GEN  PORT
```

In this example, pressing **<DOWN>** will take you to the next setpoint screen in the SETUP/FX/INPUT menu.

```
SETUP/FX/INPUT---P00
Input setup
completed
      TOP SETUP  MAIN
```

In this example, pressing **<TOP>** will take you to the first setpoint screen in the SETUP/FX/INPUT menu. **<SETUP>** will return you to the SETUP/FX screen, and **<MAIN>** will take you back to the Main screen.

```
SETUP/FX/INPUT---P00
ac transfer     GRID
control
DOWN  GRID GEN  PORT
```

In this example, pressing **<GRID>** will change the FX AC transfer control to **GRID** mode. Conversely, pressing **<GEN>** will change the FX AC transfer control to **GEN** mode.

```
SETUP/FX/INPUT---P00
ac1/grid      60 aac
limit
DOWN  INC  DEC  PORT
```

In this example, pressing **<INC>** or **<DEC>** will change the numerical value of the **ac1/grid limit** setting.

```
ADV/FX/AUX-------P00
aux output     Remote
function

DOWN  INC  DEC  PORT
```

In this example, there are multiple operating modes for the aux output function. Pressing **<INC>** or **<DEC>** will cycle through the available modes.

2.2.4 The ‘INV’ Hot Key

The OutBack MATE includes an **INV** “hot” key to allow direct control of the inverter from anywhere in the menu system. The **INV** key is located on the right side of the MATE LCD display. Pressing the **INV** key will take you to the INVERTER CONTROL menu section as shown below.

A green LED indicator is located above the **INV** key which flashes when the inverter is either in the search or power save modes, and is on continuously when full AC output voltage is available from the inverter. When the inverter is turned off or when the AC input source is being used, the green LED will not be illuminated.

When an OutBack HUB is employed, the **INVERTER CONTROL** options effect all FX inverters on the HUB.

INV

```
INVERTER CONTROL
currently:        ON

OFF  SRCH   ON    OK
```

<OFF>	Turns all the inverters connected to the MATE off
<SRCH>	Causes the inverter to begin operating in the search mode if the AC load connected is smaller than allowed by the programming of the search function.
<ON>	Turns all the inverters connected to the MATE on
<OK>	Returns to the point in the menu system where you entered the **INVERTER CONTROL** screen

2.2.5 The ‘AC IN’ Hot Key

The OutBack MATE includes an **AC IN** “hot” key to allow direct control of the AC input from anywhere in the menu system. The **AC IN** key is located on the left side of the MATE LCD display.

Above the **AC IN** key is a yellow LED indicator which flashes when an AC source is available but not connected and which is on continuously when the AC source is connected and in use. If no AC source is connected the yellow LED indicator will remain off.

AC IN

```
AC INPUT CONTROL
currently:       USE

DROP  USE         OK
```

Pressing the **AC IN** key once brings up the **AC INPUT CONTROL** screen. This screen allows the user to select whether the FX inverters connect to the AC input source. When an OutBack HUB is employed, the **AC INPUT CONTROL** only effects the Master FX connected to PORT 1. The Master then echoes the command to all of its slaves.

<USE>	Enables the inverter to connect to the AC source when it is available
<DROP>	Disconnects the AC input source but will allow it to be reconnected if the battery gets low or the inverter is overloaded
<OK>	Returns to the point in the menu system from you entered the **AC INPUT CONTROL** screen

Continued on next page

AC IN AC IN

```
GEN START CONTROL
Currently:        Auto

OFF   AUTO   ON     OK
```

Pressing the **AC IN** key a second time brings up the **GEN START CONTROL** screen. This screen allows the user to change the Advanced Generator Start (AGS) mode. Modes can only be changed when Advanced Generator Start is enabled (See section 4.3 Advanced Generator Start for more information). When an OutBack HUB is employed, the **GEN START CONTROL** only effects the FX that has been programmed as the AGS PORT in the AGS menu.

<OFF>	Manually overrides AGS mode and shuts off the generator
<AUTO>	Allows the MATE to automatically start and stop the generator according to the settings programmed in the AGS menu
<ON>	Manually overrides AGS mode and starts the generator
<OK>	Returns to the point in the menu system where you entered the **GEN START CONTROL** screen

---

AC IN AC IN AC IN

```
CHARGER CONTROL
currently:         OFF

OFF  AUTO          OK
```

Pressing the **AC IN** key a third time brings up the **CHARGER CONTROL** screen. This allows operation of the battery charger to be preset for when an AC source is available. The charger's operation is independent of the inverter: you can set the charger to come on when AC is available but have the inverter stay off when AC is disconnected. When an OutBack HUB is employed, the **CHARGER CONTROL** only effects the Master FX connected to PORT 1. The Master then echoes the command to all of its slaves.

<OFF>	Disables all charger functions in the FX
<AUTO>	Enables automatic battery charging when an AC input source is connected
<OK>	Returns to the point in the menu system where you entered the **CHARGER CONTROL** screen

---

AC IN AC IN AC IN AC IN

```
CHARGER MODE CONTROL
Global charger mode

BULK    EQ            OK
```

```
BULK CONTROL


START  STOP           OK
```

```
CHARGER MODE CONTROL
Global charger mode

BULK    EQ            OK
```

Pressing the **AC IN** key a fourth time brings up the **CHARGER MODE CONTROL** screen. This screen allows the MATE to issue system wide (global) charger commands. Both OutBack MX and FX products will respond to global charger commands.

Pressing **<BULK>** brings up the **BULK CONTROL** screen, it will allow the user to start and/or stop a bulk charge cycle manually by pressing **<START>** or **<STOP>** respectively.

Pressing **<EQ>** brings up the **EQUALIZE CONTROL** screen.

When the **<START>** has been selected, two informational screen are displayed. The user then must answer **<YES>** before an equalize charging cycle is allowed to begin.

Once the equalizing process has started, you can stop it at anytime by selecting **<STOP>** from this same control screen.

NOTE: For a global charger command to work, all of the OutBack products must be connected to a HUB. The **CHARGER MODE CONTROL** effects both FX inverters ***and*** MX60 charge controllers. This requires that the FX and MX firmware versions support this feature (See section 7.0 Troubleshooting if this command fails to function).

2.3 Common Screens

2.3.1 The Main Screen

```
MAIN-----------------------------
         12:00:30P

SUM STATUS SETUP ADV
```

After the power-up screens is the Main screen. It is the root, or home screen to the entire menu structure. If you get lost exploring the MATE's many screens, press the two left soft keys ***simultaneously*** to return to the Main Screen from anywhere in the menu system. Additionally, most menu branches end with a soft key labeled **<MAIN>**; pressing this button will return you to the Main screen.

2.3.2 Summary Screens

The Summary screens provided by the MATE summarize the current status of all the OutBack products connected to it. Summary screens can be accessed from the Main screen by pressing the **<SUM>** button or can be set to pop up like a screen saver after a delay (See section 3.3 Summary Screen Options for more setup information). Any MATE button pressed while the Summary screen is being displayed returns you to the screen that was active before the summary screen was displayed.

```
DC<>AC   .......  0.0kw
AC Load  ..................
Buying   ..................
Battery            25.6V
```

If the MATE has one or more FXs connected to it, an FX summary screen will be displayed. It shows three bar graphs that summarize power flow in an FX system. Each bar graph is made up of segments that roughly represent 500 watts of power per FX inverter connected (ex. With 2 FXs, each segment would represent 1000 Watts).

```
DC<>AC   >>>... 1.5kw
```

The DC<>AC bar graph represents the amount of power conversion happening in the system. It could be either the FX's inverting and supplying AC power to the loads, or the FX's charging the batteries with an AC input source. There is also a numerical read-out (in kilowatts) in the upper right hand corner.

```
AC Load   ☼☼☼......
```

The AC LOAD bar graph shows the amount of power that the FX is sending out its AC OUTPUT to power loads. This bar graph should equal the DC<>AC bar graph when all the FXs in a system are inverting and will equal pass-thru loads when all the FXs are connected to an AC source.

```
Buying      $$$$$......
```

The next bar graph denotes the power coming in or going out of the AC input terminals of the FX. Its label can be Buying when the AC input source is providing power to the FX and loads or Selling when the FX is exporting excess battery capacity back to the Grid.

```
Battery           26.5V
```

The last line is for displaying battery voltage.

```
-------------------------------
MX CHARGER     1.5kw
>>>.........................
Battery           25.6V
```

If the MATE has one or more MX60 MPPT charge controllers attached to it, an MX summary screen will be displayed. Each arrow displayed on the MX summary screen is equal to 500 watts per MX (ex. With 3 MXs, each arrow would represent 1500 watts).

NOTE: A MATE connected to a HUB with both FXs and MXs connected to it will switch between both types of summary screens every 20 seconds.

2.3.3 Status Screens

The Status menu that can be accessed by pressing **<STATUS>** on the Main screen contains all the meters and mode displays for OutBack products that are connected to the MATE.

MAIN----------------------------
12:00:30P

SUM **STATUS** SETUP ADV

The Status menu is divided first by product; then it is further divided into menu categories, such as meters, modes, and statuses.

STATUS--------------------------
Choose product:

FX MX

The Status screens available differ by product type and revision. (See section 5.0 Menu Map for locations of all of the status screens available.) Consult your specific OutBack product owner manual for an explanation of all the operating modes and meters.

STATUS/FX/PAGE1------------
Choose category:

MODES METER BATT PG2

! **NOTE:** Not all Status screens are applicable to all FX models. An example would be; none Grid-Tie FX may not display grid-tie parameters.

2.3.4 Setup Screens

The Setup screens allow the user to adjust basic setpoints for the MATE and FX inverters. Changing Setpoints in the MX60 is not supported via the MATE at this time. Pressing **<SETUP>** from the Main screen allows the user to choose the FX or the MATE setup menu.

MAIN----------------------------
12:00:30P

SUM STATUS **SETUP** ADV

MATE Setup will be covered in section 3.0 MATE Setup.

The FX Setup menu will allow the user to change Search and Input settings only. Refer to the FX user manuals for an explanation of these settings and their functions.

SETUP/FX------------------------
Choose category:

SRCH INPUT MAIN

2.3.5 Advanced Screens

The Advanced menu system is where most of the initial system settings are programmed. Because changing these settings could adversely effect how the system operates, the user must input a password to enter the advanced menus. The settings under the Advanced menu should only be changed by someone that has read and understands the specific products (FX or MX) users manual.

The Advanced menus can be accessed by pressing the **<ADV>** from the Main screen. Pressing **<ADV>** brings up a warning screen. Pressing any of the soft keys at the warning screen will bring the user to the password screen.

MAIN----------------------------
12:00:30P

SUM STATUS SETUP **ADV**

Using the **<INC>** or **<DEC>** buttons changes the number displayed to match the Advanced menus password. When the password is set, press **<ENTER>** to go into the Advanced menu. Pressing **<EXIT>** will return the user to the Main screen.

ADV/PASSWORD--------------
Enter the password
132
ENTER INC DEC EXIT

The Advanced Menu Password is 141

2.3.5 Advanced Screens cont.

The Advanced menus allow the user to set most of the initial system setpoints for the FX, MX, and MATE. After entering the password choose the product you would like to change the Advanced settings for.

The FX Advanced menus have categories like:

- INV – Inverter setup
- CHGR – Charger setpoints
- GRID – Grid input setpoints
- GEN – Generator input setpoints
- AUX – FX Aux output settings
- STACK – FX stacking setup
- SELL – Grid-Tie setup
- CAL – FX meter calibrations

NOTE: Not all Advanced menu screens are applicable to every model FX. An example would be a non Grid-Tie FX may not display grid-tie parameters, or allow their adjustment.

The MX Advanced menus only allow for the setup and control of the MX60s AUX output.

The Mate Advanced menus contain the settings for:

- HBX – High battery transfer
- GRIDUSE – Time of day grid usage
- AGS – Advanced generator starting

These advanced settings are covered in section 4.0 Mate Control Modes

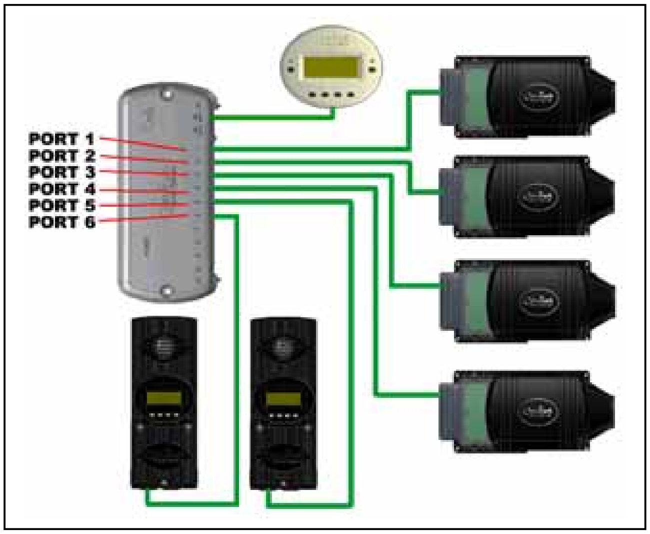
2.4 Using the MATE with a HUB

A HUB-4 or HUB-10 can be used to connect multiple OutBack products to the MATE. A HUB-10 communication manager allows a single MATE to control and monitor a maximum of ten OutBack products, while a HUB-4 is limited to four OutBack products.

A HUB has 4 to 10 ports labeled 1-10 for various OutBack products to be plugged into.

When setting-up a HUB based system to work with the MATE, several guidelines must be followed:

> A system comprised of all FX inverters must have the Master FX plugged into Port 1 of the HUB.
>
> A system comprised of all MX charge controllers must have one of the MXs plugged into Port 1.
>
> A system that has a mix of FXs and MXs must have the Master FX plugged into Port 1 and have the slave FXs plugged into the next lowest numbered Ports. For example, if a system comprised of 4 FX's and 2 MX's, the FXs must be plugged into Ports 1 – 4; the MXs can be plugged into any Port numbered greater then 4.



When first powering-up the system, make sure all of the OutBack products are plugged into the HUB and powered before plugging the MATE into the HUB.

When a MATE that is plugged into a HUB powers up, it will first display that it has found the HUB.

Searching
for Devices
HUB Found

Next it will display the Port Assignment screen. This screen shows all of the connected devices and what Port that they are found on. If a connected device is not shown on this screen, check that it is connected correctly and is powered up. Then either unplug and plug the MATE back into the HUB or use the REPOLL command described in the MATE Setup section to force the MATE to rediscover all devices.

Port Assignment
1>FX 2>FX 3>FX 4>FX
5>MX 6>MX 7>-- 8>--
9>-- 10>-- 2M>--

Once powered up, the MATE operation with a HUB is basically the same as when the MATE is directly connected to an OutBack product.

STATUS/FX/METER------**P01**
Output 120vac
Voltage
DOWN UP TOP **PORT**

The most important difference is the Port Identifier in the upper right hand corner of most screens. The number after the **P** in **P01** tells you that the meter reading currently displayed on the screen is coming from the FX in Port 1. By pressing the **<PORT>** button, you can cycle through all of the devices on the system.

NOTE: When the user is in a menu that is dedicated to FXs, only FX Ports can be cycled through by pressing the **<PORT>** button. Using the above system as an example, only **P01** , **P02** , **P03** , and **P04** will be displayed when the **<PORT>** button is pushed while in a FX menu. Conversely, only **P05** and **P06** will be displayed when the **<PORT>** button is pressed in an MX menu.

NOTE: Any time a new device is plugged into a HUB or an existing device is moved to a different Port, the MATE must be either unplugged and plugged back into the HUB or the REPOLL command described in the MATE Setup section must be used to force the MATE to rediscover all devices.

3.0 MATE Setup

This section will take you through the MATE specific setup, allowing you to change the display settings, set the Mates clock, and set various MATE control settings.

```
MAIN----------------------------
            12:00:30P

SUM STATUS SETUP ADV
```

Besides the clock display, the Main screen has four menu choices that correspond with the four soft keys under them.

```
SETUP---------------------------
Choose product:

FX                         MATE
```

For now we are interested in the SETUP menu. Press the soft key under the word **<SETUP>.** The next screen gives you the choice to set up a FX or the MATE; choose **<MATE>**.

```
SETUP/MATE/PAGE1---------
Mate code rev:            300
Choose category:
CLOCK   CNT   GLOW   PG2
```

The next screen displays the MATE code revision (3.00 in the example to the left) and several Setup choices. <PG2> brings up a second screen of Setup choices.

```
SETUP/MATE/PAGE2---------
Choose category:

PG1  SUMRY  COMM  MAIN
```

3.1 Setting the clock

Pressing **<CLOCK>** lets you choose to change the date and/or time displayed by the MATE. The **<BACK>** button returns you to the previous screen. Correct time and date are required for the Mate Control Modes discussed in section 3.0 to operate correctly.

```
SETUP/MATE/CLOCK--------
  Mo 1/01/03
          12:00:00P
BACK DATE  TIME
```

3.2 Contrast adjustment

<CNT> sets the desired contrast level. **<INC>** increases the contrast level, **<DEC>;** decreases the contrast level. The LCD on the MATE automatically adjusts for most temperature changes, but the contrast might need to be changed for ambient lighting conditions.

```
SETUP/MATE/CNT------------
Contrast:                30%

BACK  INC   DEC
```

3.2 Backlight adjustment

<GLOW> sets the desired backlight mode, level, and on time. Pressing **<GLOW>** brings up several more backlight settings.

<LEVEL> controls brightness and is adjustable from 0 to 100%.

<MODE> allows user to set the backlight to always off, auto-off after a time, or always on by selecting **<OFF>**, **<AUTO>**, or **<ON>,** respectively.

```
SETUP/MATE/GLOW---------
Backlight controls

BACK  LEVEL MODE TIME
```

<TIME> sets the auto-off time limit from 1 to 60 minutes. This is how long the MATE waits after the last button press to turn off the backlight. Once the backlight has turned off, any button press on the MATE will turn it back on.

NOTE: The MATE clock does **not** automatically adjust for daylight savings time.

3.3 Summery Screen Options

<SUMRY> brings up Summary screen options.

<TYPE> allows you to choose the type of summary screen(s) displayed. Your choice is: ROLL, FXONLY, MXONLY, or NONE. Roll switches between FX and MX screens automatically if both types of products are connected to the MATE. FXONLY or MXONLY only display the FX or MX summary screen if the respective product is connected. NONE disables the summary screen from popping up automatically, it can still be accessed via the **<SUM>** button on the Main screen.

```
SETUP/MATE/SUMMARY--
Summary control

BACK   TYPE    TIME
```

<TIME> brings up a delay setting for how long it takes for a summary screen to be displayed. Information on the summary screens is covered in section 2.3.2 Summary Screens.

3.4 Communications Options

<COMM> deals with MATE communication options. Pressing <COMM> brings up several options that can be changed.

<REPOLL> forces the MATE to 'rediscover' all the OutBack devices it is connected to. This is used any time an OutBack devices is moved or added to a HUB.

```
SETUP/MATE/COMM-------
Choose category:

BACK REPOLL  PC  DEBUG
```

<PC> will enable or disable the RS232 communications port of the MATE. This setting must be enabled if you use any third party logging or control software.

<DEBUG> allows communications errors involving the OutBack HUB to be tracked.

On the DEBUG screen, first press **<RSET>** to reset the error counting display; then press **<VIEW>** to bring up a list of HUB ports with a count of communications errors for each port.

```
SETUP/MATE/COMM-------
Comm. errors:

BACK            VIEW   RSET
```

In the example to the right, Port 4 has a large number of errors detected (04:025 means Port 4: showing 25 errors). Pressing any key will take you to the SETUP/MATE/COMM screen, which will allow the error counts to be reset using the **<RSET>** button. The DEBUG screen can be redisplayed by using the **<VIEW>** button, or the user can get back to the SETUP menu by using the **<BACK>** button.

```
00:000      01:000      02:000
03:000      04:025      05:001
06:001      07:001      08:001
09:001      10:001      2M:001
```

Use the information on the DEBUG screen to locate the problem device. Make sure that it's DC breaker is on and that it is operating correctly. Check or replace CAT5 cables running from the HUB to that device.

4.0 Mate Control Modes

The OutBack MATE is capable of several advanced modes of operation. These modes require that the MATE remain connected to at least one OutBack FX inverter at all times. The first two modes automatically use the MATE commands **DROP** and **USE** to allow the FX to connect to an AC input source only at specified times or battery levels.

A manual **USE** or **Drop** command can be issued by pressing the **<ACIN>** button until the AC INPUT CONTROL screen is reached. **<USE>** tells the FX to go ahead and use the AC input source while **<DROP>** will tell the FX to ignore any AC Input source.

The settings for all of the MATE Control Modes are under the ADVANCED menu. From the Main screen press **<ADV>** and enter the password for access to the ADVANCED menus. Once the ADVANCED menu has been entered, choose **<MATE>** and you should see a screen similar to the one on the right. At this point you can choose which MATE Control Mode you would like to setup.

```
ADV/MATE--------------------
Choose category:

HBX  GRIDUSE  AGS   ADV
```

4.1 HBX Mode

HBX stands for high battery transfer. It is a mode primarily used in applications that have enough RE power production to meet the needs of the loads most of the time. HBX mode will only allow the FX to connect to an AC source if the battery voltage has fallen below a programmable setpoint for a user configurable amount of time. The MATE will then allow the FX to remain connected to the AC source until the battery voltage has risen above a second setpoint for a programmable amount of time.

NOTE: HBX Mode in a multi-inverter installation utilizing a HUB-4 or HUB-10 will control the Master FX in port 1. The Master will then instruct any stacked slaves to **USE** or **DROP** the AC input source.

HBX-USE GRID SETPOINT: This is the voltage setpoint for when the FX will be allowed to **USE** its AC input source. The battery voltage must remain below this voltage for the amount of time set by **HBX-USE GRID DELAY** for a **USE** to be issued. **<INC>** and **<DEC>** buttons can be used to change the value.

```
ADV/MATE/HBX--------------
hbx-use              24.0 vdc
grid setpoint
DOWN   ADV      INC   DEC
```

HBX-USE GRID DELAY: This setpoint is the amount of time that battery voltage must remain below **HBX-USE GRID SETPOINT** before a **USE** command is sent. It can range from 00.1 hrs to 24.0 hrs in 0.1 hour increments.

```
ADV/MATE/HBX--------------
hbx-use              01.0 hrs
grid delay
DOWN     UP      INC   DEC
```

HBX-DROP GRID SETPOINT: This is the voltage at which the FX will be allowed to **DROP** it's AC input source. The battery voltage must remain above this voltage for the amount of time set by **HBX-DROP GRID DELAY** for a **DROP** to be issued.

```
ADV/MATE/HBX--------------
hbx-drop             26.0 vdc
grid setpoint
DOWN     UP      INC   DEC
```

HBX-DROP GRID DELAY: This setpoint is the amount of time that battery voltage must remain above **HBX-DROP GRID SETPOINT** before a **DROP** command is sent. It can range from 00.1 hrs to 24.0 hrs in 0.1 hour increments.

```
ADV/MATE/HBX--------------
hbx-drop             01.0 hrs
grid delay
DOWN     UP      INC   DEC
```

AC INPUT CONTROL: With this screen, HBX Mode can be enabled or disabled. Pressing **<CHANGE>** allows you to change the current mode.

Before enabling HBX Mode make sure that the FX is in **DROP** mode by pressing **<DROP>**. The screen should indicate **DROP** mode. Enable HBX by pressing the **<HBX>** button. The screen will now indicate that the MATE is running in HBX mode by displaying the current state, **USE** or **DROP** followed by **–HBX**.

To disable HBX Mode, simply press the **<HBX>** button again. After disabling HBX make sure to reset the **DROP** or **USE** to whatever state is desired.

Pressing **<DONE>** returns you to the HBX menu where you can exit back to the ADVANCED menu by using either the **<UP>** or **<DOWN>** buttons.

```
ADV/MATE/HBX--------------
ac input             USE
control
DOWN     UP        CHANGE
```

```
ADV/MATE/HBX--------------
ac input           DROP-HBX
control
DROP   USE    HBX    DONE
```

NOTE: Even with HBX mode enabled, the user can issue manual **DROP** or **USE** commands using the AC INPUT CONTROL found under the **ACIN** button.

4.2 Grid-Use Mode

Grid-Use mode is for time of day based grid usage. It allows you to program the time of day that the FX will connect to the AC input source. You must ensure that the time and date is properly programmed for Grid-Use mode to function properly (See section 3.0 MATE Setup).

Grid-Use mode will allow the user to choose the time of day that the FX will **USE** the AC input source, and is good for taking advantage of cheaper utility rates during off-peak hours. Grid-Use time can be programmed separately for weekday vs. weekend connect times. Care must be taken when programming weekday and weekend times that encompass USE periods past midnight (12:00 am). The user must take into account weekday USE periods that will end on a Saturday.

Example #1:

Weekday Start 6:00 PM	Weekday Stop 6:00 AM
Weekend Start 12:00 AM	Weekend Stop 12:00 AM

The weekend USE period has been left at its default. Any time that a Start time equals a Stop time, no action will be taken. This results in the time period being ignored. The above settings will have the following results:

Mon – Thr evenings at 6PM the MATE will issue a USE command to the FX allowing the AC input source to be used. Additionally, every morning (Mon – Thr) at 6AM a DROP will be issued. On FRI evening at 6PM a USE will be issued but since the Weekend Start and Stop times are equal, the weekend use time is disabled No DROP will be issued until Mon morning at 6AM.

Example #2:

Weekday Start 6:00 PM	Weekday Stop 6:00 AM
Weekend Start 4:00 PM	Weekend Stop 8:00 AM

Mon – Thr evenings at 6PM the MATE will issue a USE command to the FX allowing the AC input source to be used. Additionally, every morning (Mon – Thr) at 6AM a DROP will be issued. On FRI evening at 6PM a USE will be issued. The following morning is a weekend (Sat) so a DROP command will be issued at 8AM. Sat evening at 4PM the FX will USE again until Sun morning at 8AM. Sun evening at 4PM a USE time period will start, ending on Mon morning at 6AM.

NOTE: If the battery falls below the FX Low Battery Cut-off voltage, the FX will automatically connect to the AC input source regardless of the **GRID-USE** time of day setting.

NOTE: Because GRID-USE mode uses the **DROP** and **USE** commands, it cannot be enabled at the same time as HBX mode. Enabling GRID-USE will automatically disable HBX mode.

Grid-Use cont. on next page

GRID-USE ENABLE: This screen actually turns **GRID-USE** mode **<ON>** or **<OFF>**. Make sure that all of the **GRID-USE** parameters are set before enabling **GRID-USE** mode. The **GRID-USE** settings can be accessed by using the **<DOWN>** button.

```
ADV/MATE/GRIDUSE--------
griduse enable:       Off

DOWN   ADV     OFF  ON
```

WEEKDAY GRID-USE START: This setting is the time during the week (Mon – FRI) that a **USE** will be issued to an FX, allowing the FX to connect to the AC input source. The time displayed is the current setting. To change the time press **<CHANGE>**.

```
ADV/MATE/GRIDUSE--------
weekday            12:00A
griduse start
DOWN   ADV     CHANGE
```

Using the **<INC>** and **<DEC>** buttons, set the hour to the desired time. Then press **<DOWN>**.

```
WEEKDAY GRDUSE START
Adj hour           12:00A

DOWN   INC  DEC
```

Using the **<INC>** and **<DEC>** buttons, set the minutes to the desired time. Then press **<DONE>**.

```
WEEKDAY GRDUSE START
Adj min            12:00A

           INC  DEC  DONE
```

WEEKDAY GRID-USE STOP: This setting is the time during the week (Mon – FRI) that a **DROP** will be issued to an FX, forcing FX to disconnect from the AC input source. The time displayed is the current setting. To change the time press **<CHANGE>**.

```
ADV/MATE/GRIDUSE--------
weekday            12:00A
griduse stop
DOWN   ADV     CHANGE
```

WEEKEND GRID-USE START: This setting is the time during the weekend (Sat & Sun) that a **USE** will be issued to an FX, allowing the FX to connect to the AC input source. The time displayed is the current setting. To change the time press **<CHANGE>**.

```
ADV/MATE/GRIDUSE--------
weekend            12:00A
griduse start
DOWN   ADV     CHANGE
```

WEEKEND GRID-USE STOP: This setting is the time during the weekend (Sat & Sun) that a **DROP** will be issued to an FX, forcing FX to disconnect from the AC input source. The time displayed is the current setting, to change the time press **<CHANGE>**.

```
ADV/MATE/GRIDUSE--------
weekend            12:00A
griduse stop
DOWN   ADV     CHANGE
```

NOTE: A Start time that equals a Stop time disables USE time for that period (weekday or weekend).

4.3 Advanced Generator Start Mode

Advanced Generator Start (AGS) Mode utilizes the AUX output found on FX inverters and is compatible with any 2 wire start generator. AGS allows the user to choose a variety of conditions that will start a generator by energizing the FX AUX output.

AGS will start the generator anytime one or more of the Gen Start conditions are true, and will stop the generator only when all of the conditions are false.

After AGS starts a generator, the FX must connect to the generator within a 5 minute window. If the FX fails to connect within 5 minutes, a Genstart error is displayed by the MATE, and all subsequent AGS conditions will be ignored until the AGS mode has been reset. AGS mode can be reset by using the **GEN START CONTROL** found by pressing the **<ACIN>** button twice. Pressing **<OFF>** and then **<AUTO>** resets all AGS parameters. The generator can also be manually started using the **GEN START CONTROL** screen by pressing **<ON>**. If the user wants the generator to auto stop after a charge cycle is complete, the user can press the **<AUTO>** button after the generator has been started by pressing **<ON>**.

The following is a discussion of all the AGS setup parameters and start condition available to the user:

4.3.1 AGS Setup

The AGS Setup menu contains the following general settings that define how the rest of the AGS routines will work:

AGS Port:

The MATE can use any AUX output of an FX that is connected to it either directly or via an OutBack HUB-4 or HUB-10. If a HUB is used, the MATE must be told what Port that the desired FX resides on. If no HUB is used and the MATE is directly plugged into an FX, then the AGS Port needs to be set to 0 (zero). If a HUB is used, the numbered jack that the desired FX is connected to on the HUB should be set as the AGS Port.

```
 MATE/AGS/SETUP-----------
Ags port:                  0

DOWN   AGS     INC    DEC
```

Example:

A MATE is connected to a HUB-10 that has four FXs and three MXs connected to it. The FXs are plugged into Ports 1 – 4, as labeled on the HUB, and the MXs are plugged into Ports 5 – 7. The FX connected to Port #3 will have its AUX output wired to the generator, so the AGS Port should be set to '3'.

AGS Control:

This screen allows the AGS mode to be changed. Pressing **<CHANGE>** brings up a screen that allows the user to switch AGS from Manual to Auto.

An **<OFF>** de-energizes the FX AUX output and stops the generator regardless of any AGS setting; this is displayed as MAN – OFF.

An **<AUTO>** will allow the AGS settings to start and stop the generator automatically, and is displayed as either AUTO – ON (when the generator is running), or AUTO – OFF (when the generator is stopped).

An **<ON>** will energize the FX AUX output and start the generator regardless of any AGS setting, this is displayed as MAN – ON.

```
ADV/MATE/AGS/SETUP-----
Ags control:        MAN-Off

DOWN   UP    CHANGE
```

```
GEN START CONTROL
currently:           MAN-Off

OFF    AUTO      ON      OK
```

AGS Enabled:

This is the overall control for AGS. If AGS is not enabled, none of the AGS settings or controls will work.

```
ADV/MATE/AGS/SETUP-----
Ags enabled:               NO

DOWN    UP      NO      YES
```

DC Genset:

A Yes means that you have a DC generator and that AGS routines which normally stop the generator upon the FX going to Float or Silent will instead stop the generator when the **VDC Genstop** setting is reached.

```
ADV/MATE/AGS/SETUP-----
Dc genset:                 NO

DOWN    UP      NO      YES
```

VDC Genstop:

This voltage setting will terminate a Voltage Start Genstart when the battery voltage remains above it for 15 min regardless of the **DC Genset** setting.

```
ADV/MATE/AGS/SETUP-----
Vdc genstop:          38.0 vdc

DOWN    UP      INC     DEC
```

4.3.2 Quiet Time

Quiet Time is a time period during which the MATE will not allow most AGS settings to start the generator. This is usually set-up as night time when a running generator would be an annoyance. Quiet Times can be set individually for weekday and weekend, and consist of a Quiet Time Start and a Quiet Time Stop.

WEEKDAY START:

Weekday Quiet Time start is the beginning of the quiet time period for Mon - Fri, most AGS start conditions will be stopped at this time. Press **<CHANGE>** to adjust the hour and minutes settings.

```
ADV/MATE/AGS/QT----------
weekday:            12:00A
quiet time start
DOWN   AGS       CHANGE
```

WEEKDAY STOP:

Weekday Quiet Time stop is the end of the quiet time period for Mon - Fri. Press **<CHANGE>** to adjust the hour and minutes settings.

```
ADV/MATE/AGS/QT----------
weekday:            12:00A
quiet time stop
DOWN   UP        CHANGE
```

WEEKEND START:

Weekend Quiet Time start is the beginning of the quiet time period for Sat & Sun, most AGS start conditions will be stopped at this time. Press **<CHANGE>** to adjust the hour and minutes settings.

```
ADV/MATE/AGS/QT----------
weekend:            12:00A
quiet time start
DOWN   UP        CHANGE
```

WEEKEND STOP:

Weekend Quiet Time stop is the end of the quiet time period for Sat & Sun. Press **<CHANGE>** to adjust the hour and minutes settings.

```
ADV/MATE/AGS/QT----------
weekend:            12:00A
quiet time stop
DOWN   UP        CHANGE
```

4.3.3 Voltage Start

There are three voltage start setpoints in AGS Mode that the user can adjust. After a generator is started due to a Voltage Start setting, it will be stopped when the FX reaches Float or Silent mode, or based on the **VDC Genstop** setting in AGS Setup menu previously explained.

24 Hour voltage setpoint:

If the battery voltage falls below this setpoint, a 24 hour timer starts to count down. On reaching zero, a genstart is sent to the FX inverter unless it is currently Quiet Time.

```
ADV/MATE/AGS/VSTART--
Volt start         24.4 vdc
24 hr setting
DOWN   AGS   INC    DEC
```

---

2 Hour voltage setpoint:

If the battery voltage falls below this setpoint, a 2 hour timer starts to count down. On reaching zero, a genstart is sent to the FX inverter unless it is currently Quite Time.

```
ADV/MATE/AGS/VSTART--
Volt start         23.6 vdc
2 hr setting
DOWN   UP    INC    DEC
```

---

2 Minute voltage setpoint:

If the battery voltage falls below this setpoint, a 2 minute timer starts to count down. On reaching zero, a genstart is sent to the FX inverter ***even*** if it is currently Quite Time.

```
ADV/MATE/AGS/VSTART--
Volt start         22.0 vdc
2 min setting
DOWN   UP    INC    DEC
```

4.3.4 Load Start

Load Start will start a generator whenever the total system AC Load exceeds the setpoint for the programmed amount of time. The generator will then be stopped when the AC load has dropped below a Load Stop setpoint for a programmed amount of time.

Load Start KW:

An AGS genstart will be issued when the total AC load of all the FXs connected to the MATE exceeds this setting for the amount of time set with **Load Start Delay**. A zero disables any load start function. **<INC>** and **<DEC>** adjusts this setting between 1 – 50kW.

```
ADV/MATE/AGS/LS----------
Load start             0 kw

DOWN   AGS   INC    DEC
```

Load Start Delay:

This setting is the delay time that the total system AC load must remain above **Load Start kW** , before the generator is started. It is adjustable from 1 to 240 minutes.

```
ADV/MATE/AGS/LS----------
load start            1 min
delay
DOWN   UP   INC    DEC
```

Load Stop KW:

An AGS genstop will be issued when the total AC load of all the FXs connected to the MATE fall below this setting for the amount of time set with **Load Stop Delay**. This setting excludes any FX charger current for its AC load calculation. Only when the power being provided to the FXs' AC output falls below this setting, will the generator be stopped.

```
ADV/MATE/AGS/LS----------
Load stop              0 kw

DOWN   UP   INC    DEC
```

Load Stop Delay:

This setting is the delay time that the total system AC load must remain below **Load Stop kW** , before the generator is stopped. It is adjustable from 1 to 240 minutes.

```
ADV/MATE/AGS/LS----------
load stop             1 min
delay
DOWN   UP   INC    DEC
```

4.3.5 Must Run

Must Run Time is a daily time period that the MATE will command the generator to run every day. Must Run Times can be set individually for weekday and weekend, and consist of a Must Run Start time and a Must Run Stop time. Setting Must Run start and stop times to the same time, disables the Must Run function.

WEEKDAY START:

Weekday Must Run start time is the beginning of the time period , Mon - Fri, that the generator will be forced to run. Press **<CHANGE>** to adjust the hour and minutes settings.

```
ADV/MATE/AGS/MR----------
weekday:              12:00A
must run start time
DOWN   AGS        CHANGE
```

WEEKDAY STOP:

Weekday Must Run stop time is the end of the Must Run time period for Mon - Fri. Press **<CHANGE>** to adjust the hour and minutes settings.

```
ADV/MATE/AGS/MR----------
weekday:              12:00A
must run stop time
DOWN   UP         CHANGE
```

WEEKEND START:

Weekend Must Run start time is the beginning of the time period , Sat & Sun, that the generator will be forced to run. Press **<CHANGE>** to adjust the hour and minutes settings.

```
ADV/MATE/AGS/MR----------
weekend:              12:00A
must run start time
DOWN   UP         CHANGE
```

WEEKEND STOP:

Weekend Must Run stop time is the end of the Must Run time period for Sat & Sun. Press **<CHANGE>** to adjust the hour and minutes settings.

```
ADV/MATE/AGS/MR----------
weekend:              12:00A
must run stop time
DOWN   UP         CHANGE
```

4.3.6 Exercise

An Exercise time can be set by choosing a day of the week (Sun – Sat), a start time of day (12AM – 11:59PM), and a exercise period (1 – 240 minutes). On the first occurrence of the chosen day of the week each month, at the programmed start time, the generator will start and run for the programmed period.

EXERCISE START DAY (exstartday):

This is the day of the week that the generator will start on. This can be set to Mon – Fri, and Sat or Sun, depending on what day each month a generator exercise period should be run. The setting "- -" disables any exercise period.

```
ADV/MATE/AGS/EX----------
exstartday:              --

DOWN    AGS      INC    DEC
```

EX START TIME:

This setting controls at what time on the **Exercise Start Day** the generator will start it's exercise period. Press **<CHANGE>** to adjust the hour and minutes settings.

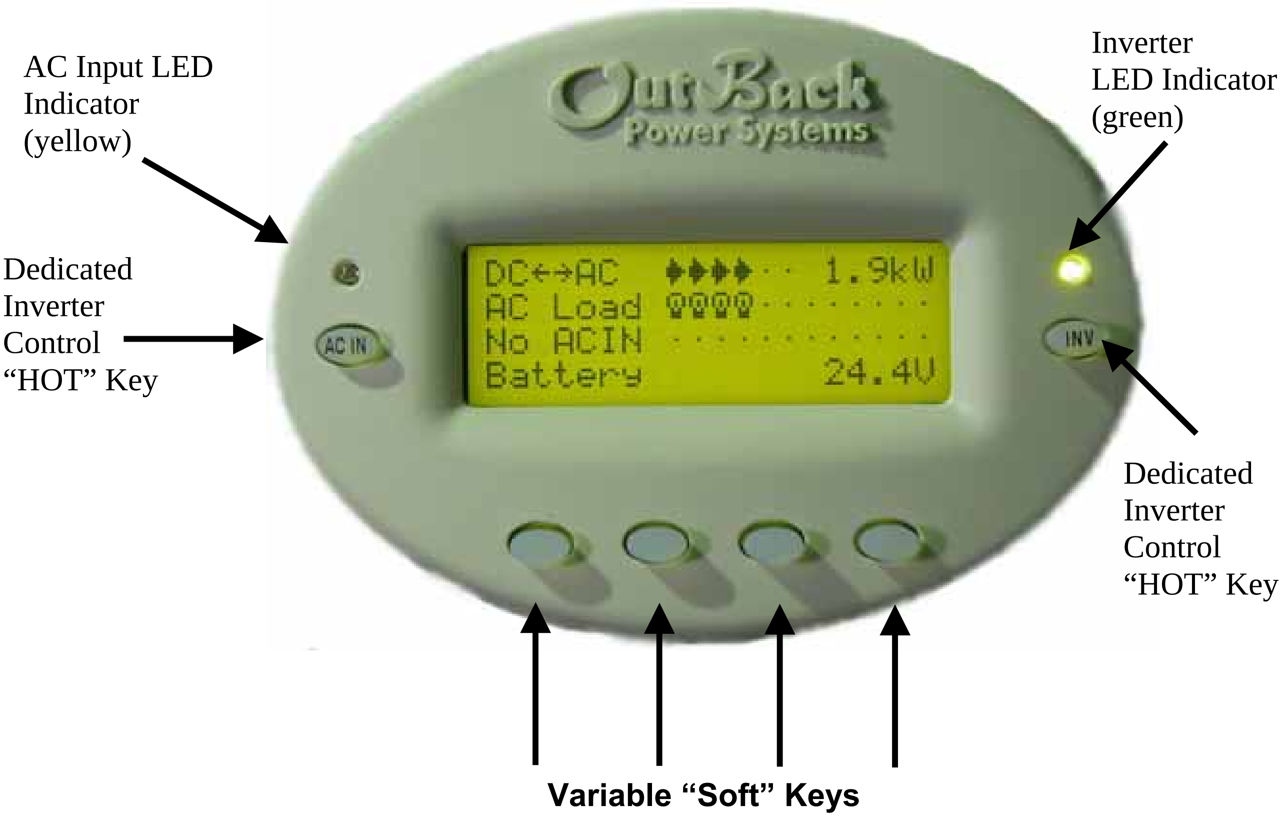
```
ADV/MATE/AGS/EX----------
Ex start time:        12:00A

DOWN    UP          CHANGE
```

EX PERIOD:

Ex Period is how long a generator exercise period will be. **<INC>** and **<DEC>** can change the value between 1 – 240 minutes.

```
ADV/MATE/AGS/EX----------
Ex period:            15 min

DOWN    UP       INC    DEC
```

5.0 Menu Map


AC Input LED
Indicator
(yellow)
Inverter
LED Indicator
(green)
Dedicated
Inverter
Control
“HOT” Key
AC IN
DC↔AC 1.9kW
AC Load
No ACIN
Battery 24.4V
INV
Dedicated
Inverter
Control
“HOT” Key
Variable “Soft” Keys

each one of the soft keys corresponds to a word
on the bottom line of the LCD display

The menu system displayed on the MATE will vary depending on the software version that the MATE was programmed with at the time of manufacturing or during its last software upgrade.

The following pages give a basic idea of the menu structure and how you navigate through the menu system to the different programming levels. Some changes from these specific displays may be present in your installation.

CONTROL KEYS

Inv Hot Key

INV

```
INVERTER CONTROL
currently:      ON

OFF  SRCH   ON    OK
```

AC IN Hot Key

AC IN

```
AC INPUT CONTROL
currently: DROP

DROP  USE          OK
```

AC IN *second press*

```
GEN START CONTROL
currently:   MAN-OFF

OFF  AUTO  ON     OK
```

AC IN *third press*

```
CHARGER CONTROL
currently:     OFF

OFF  AUTO          OK
```

AC IN *fourth press*

```
CHARGER MODE CONTROL
Global charger mode

BULK   EQ          OK
```

Summary Screens

```
MAIN----------------
6:54:42P

SUM STATUS SETUP ADV
```

↓

```
DC<>AC. . . .  0.0kW
AC Load . . . . . .
Buying  . . . . . .
Battery        25.6V
```

```
- - - - - - - - - -
MX CHARGER. . . . .

Battery        25.6V
```

STATUS MENU--FX

MODES

```
MAIN----------------
      6:54:42PM

SUM STATUS SETUP ADV
```

↓

```
STATUS--------------
choose product:

FX   MX
```

↓

```
STATUS/FX/PAGE1-----
choose category:

MODES METER BATT PG2
```

↓

```
STATUS/FX/MODE---P00
inv control:      ON
          CHANGE
DOWN  STAT MODE PORT
```

↓

```
INVERTER CONTROL
currently:      ON

OFF  SRCH   ON    OK
```

↓

```
STATUS/FX/MODE---P00
inv control:      ON
          CHANGE
DOWN  STAT MODE PORT
```

↓

```
STATUS/FX/MODE---P00
ac in control:   USE
          CHANGE
DOWN  UP   MODE PORT
```

↓

```
AC INPUT CONTROL
currently:       USE

DROP  USE         OK
```

↓

```
STATUS/FX/MODE---P00
ac in  control:  USE
          CHANGE
DOWN  UP   MODE PORT
```

↓

```
STATUS/FX/MODE---P00
chr control:    AUTO
          CHANGE
DOWN  UP   MODE PORT
```

↓

```
CHARGER CONTROL
currently:      AUTO

OFF  AUTO         OK
```

↓

```
STATUS/FX/MODE---P00
chr control:    AUTO
          CHANGE
DOWN  UP   MODE PORT
```

↓

```
STATUS/FX/MODE---P00
aux control:    AUTO
          CHANGE
DOWN  UP   MODE PORT
```

↓

```
AUX OUTPUT CONTROL
currently:      AUTO

OFF  AUTO  ON     OK
```

MODES cont.

```
STATUS/FX/MODE---P00
aux control:    AUTO
          CHANGE
DOWN  UP   MODE PORT
```

↓

```
STATUS/FX/MODE---P00
eq control:       NO
          CHANGE
        UP MODE PORT
```

↓

```
EQUALIZE CONTROL
eq enabled:       NO

STOP START        OK
```

METERS

```
MAIN----------------
      6:54:42P

SUM STATUS SETUP ADV
```

↓

```
STATUS--------------
choose product:

 FX   MX
```

↓

```
STATUS/FX/PAGE1-----
choose category:

MODES METER BATT PG2
```

↓

```
MODE: SILENT     P00
inv 0.0kw  zer 0.0kw
chg 0.0kw  buy 0.0kw
DOWN     STATUS  PORT
```

↓

```
STATUS/FX/METERS—P00
output       122 vac
voltage
DOWN  UP  TOP   PORT
```

↓

```
STATUS/FX/METERS—P00
input        122 vac
voltage
DOWN  UP  TOP   PORT
```

↓

```
STATUS/FX/METERS—P00
inverter     0.0 aac
current
DOWN  UP  TOP   PORT
```

↓

```
STATUS/FX/METERS—P00
charger      0.0 aac
current
DOWN  UP  TOP   PORT
```

↓

```
STATUS/FX/METERS—P00
input        0.0 aac
current
DOWN  UP  TOP   PORT
```

↓

```
STATUS/FX/METERS—P00
sell         0.0 aac
current
DOWN  UP  TOP   PORT
```

↓

cont. on next page

METERS cont

```
STATUS/FX/METERS—P00
FX firmware       50
revision
DOWN  UP  TOP   PORT
```

```
STATUS/FX/METERS—---
end of meter menu

      UP  TOP STATUS
```

BATTERY

```
MAIN----------------
      6:54:42P

SUM STATUS SETUP ADV
```

```
STATUS--------------
choose product:

 FX   MX
```

```
STATUS/FX/PAGE1-----
choose category:

MODES METER BATT PG2
```

```
STATUS/FX/BATT---P00
battery     25.0 vdc
actual
DOWN    STATUS  PORT
```

```
STATUS/FX/BATT---P00
battery     25.0 vdc
temp compensated
DOWN  UP  TOP   PORT
```

```
STATUS/FX/BATT---P00
absorb      28.8 vdc
setpoint
DOWN  UP  TOP   PORT
```

```
STATUS/FX/BATT---P00
absorb      01.5 hrs
time remaining
DOWN  UP  TOP   PORT
```

```
STATUS/FX/BATT---P00
float       26.8 vdc
setpoint
DOWN  UP  TOP   PORT
```

```
STATUS/FX/BATT---P00
float       00.8 hrs
time remaining
DOWN  UP  TOP   PORT
```

```
STATUS/FX/BATT---P00
refloat     25.0 vdc
setpoint
DOWN  UP  TOP   PORT
```

```
STATUS/FX/BATT---P00
equalize    28.8 vdc
setpoint
DOWN  UP  TOP   PORT
```

BATTERY cont

```
STATUS/FX/BATT---P00
equalize    02.0 hrs
time remaining
DOWN  UP  TOP   PORT
```

```
STATUS/FX/BATT---P00
batt temp.    255
(not in degree C/F)
DOWN  UP  TOP STATUS
```

```
STATUS/FX/BATT--—---
end of battery menu

      UP  TOP STATUS
```

ERRORS

```
MAIN----------------
      6:54:42P

SUM STATUS SETUP ADV
```

```
STATUS--------------
choose product:

 FX   MX
```

```
STATUS/FX/PAGE1-----
choose category:

MODES METER BATT PG2
```

```
STATUS/FX/PAGE2-----
choose category:

PG1 ERROR  WARN  PG3
```

```
STATUS/FX/ERROR—-P00
low ac output    NO
voltage
DOWN    STATUS  PORT
```

```
STATUS/FX/ERROR—-P00
stacking         NO
error detected
DOWN  UP  TOP   PORT
```

```
STATUS/FX/ERROR—-P00
inverter         NO
overtemp
DOWN  UP  TOP   PORT
```

```
STATUS/FX/ERROR—-P00
low battery     NO
voltage
DOWN  UP  TOP   PORT
```

```
STATUS/FX/ERROR—-P00
phase loss      NO
error
DOWN  UP  TOP   PORT
```

```
STATUS/FX/ERROR—-P00
high battery      NO
error
DOWN  UP  TOP   PORT
```

ERRORS cont

```
STATUS/FX/ERROR—-P00
ac output         NO
shorted
DOWN  UP  TOP   PORT
```

```
STATUS/FX/ERROR—-P00
ac output         NO
backfeed
DOWN  UP  TOP   PORT
```

```
STATUS/FX/ERROR—----
end of error menu

      UP  TOP STATUS
```

WARNINGS

```
MAIN----------------
      6:54:42P

SUM STATUS SETUP ADV
```

```
STATUS--------------
choose product:

 FX   MX
```

```
STATUS/FX/PAGE1-----
choose category:

METER BAT ERROR  PG2
```

```
STATUS/FX/PAGE2-----
choose category:

PG1 ERROR  WARN  PG3
```

```
STATUS/FX/WARN---P00
ac in freq        NO
to high
DOWN    STATUS  PORT
```

```
STATUS/FX/WARN---P00
ac in freq        NO
to low
DOWN  UP  TOP   PORT
```

```
STATUS/FX/WARN---P00
ac in voltage     NO
to high
DOWN  UP  TOP   PORT
```

```
STATUS/FX/WARN---P00
ac in voltage     NO
to low
DOWN  UP  TOP
```

```
STATUS/FX/WARN---P00
ac input          NO
current exceeds max
DOWN  UP  TOP   PORT
```

```
STATUS/FX/WARN---P00
temperature       NO
sensor fault
DOWN  UP  TOP   PORT
```

cont. on next page

WARNINGS cont

```
STATUS/FX/WARN---P00
internal comm    NO
error detected
DOWN  UP  TOP   PORT
```

↓

```
STATUS/FX/WARN---P00
internal fan     NO
error detected
DOWN  UP  TOP   PORT
```

↓

```
STATUS/FX/WARN---P00
Air temp        204

DOWN  UP  TOP   PORT
```

↓

```
STATUS/FX/WARN---P00
Fet temp        204

DOWN  UP  TOP   PORT
```

↓

```
STATUS/FX/WARN---P00
Cap temp        204

DOWN  UP  TOP   PORT
```

↓

```
STATUS/FX/WARN------
end of warnings menu

      UP  TOP STATUS
```

DESCONNECT REASONS

```
MAIN----------------
      6:54:42P

SUM STATUS SETUP ADV
```

↓

```
STATUS--------------
choose product:

 FX   MX
```

↓

```
STATUS/FX/PAGE1-----
choose category:

METER BAT ERROR  PG2
```

↓

```
STATUS/FX/PAGE2-----
choose category:

PG1 ERROR  WARN  PG3
```

↓

```
STATUS/FX/PAGE3-----
choose category:

PG2 DISCON SELL MAIN
```

↓

```
STATUS/FX/DISCON-P00
ac in freq       NO
to high
DOWN     STATUS PORT
```

↓

```
STATUS/FX/DISCON-P00
ac in freq       NO
to low
DOWN     STATUS PORT
```

↓

```
STATUS/FX/DISCON-P00
ac in voltage     NO
> max
DOWN   UP  TOP  PORT
```

↓

```
STATUS/FX/DISCON-P00
ac in voltage     NO
< min
       UP  TOP  PORT
```

SELL

```
MAIN----------------
      6:54:42P

SUM STATUS SETUP ADV
```

↓

```
STATUS--------------
choose product:

 FX   MX
```

↓

```
STATUS/FX/PAGE1-----
choose category:

METER BAT ERROR  PG2
```

↓

```
STATUS/FX/PAGE2-----
choose category:

PG1 ERROR  WARN  PG3
```

↓

```
STATUS/FX/PAGE3-----
choose category:

PG2 DISCON SELL MAIN
```

↓

```
STATUS/FX/SELL---P00
Stop sell        255
reason
STATUS          PORT
```

MAIN MENU SHORTCUT

Pressing the left two keys on the MATE at the same time from anywhere in the menu system takes you to the MAIN menu

STATUS MENU--MX

MODES

```
MAIN----------------
      6:54:42PM

SUM STATUS SETUP ADV
```

↓

```
STATUS--------------
choose product:

FX   MX
```

↓

```
STATUS/MX-----------
choose category:

MODE METER SETP MAIN
```

↓

```
STATUS/MX/MODE---P00
charger mode:   BULK

DOWN     STATUS PORT
```

↓

```
STATUS/MX/MODE---P00
aux relay     DIVERT
mode
DOWN  UP   TOP  PORT
```

↓

```
STATUS/MX/MODE---P00
aux relay state:  ON

DOWN  UP   TOP  PORT
```

↓

```
STATUS/MX/MODE------
end of mode menu

      UP  TOP STATUS
```

METERS

```
MAIN----------------
      6:54:42PM

SUM STATUS SETUP ADV
```

↓

```
STATUS--------------
choose product:

FX   MX
```

↓

```
STATUS/MX-----------
choose category:

MODE METER SETP MAIN
```

↓

```
MODE: SILENT     P00
pv  000 v bat 00.0 v
in   00 a out   00 a
DOWN    STATUS  PORT
```

↓

```
STATUS/MX/METER--P00
charger            w
watts
DOWN  UP  TOP   PORT
```

↓

METERS cont

```
STATUS/MX/METER--P00
charger          kwh
kwhrs
DOWN  UP  TOP   PORT
```

↓

```
STATUS/MX/METER--P00
charger          adc
amps dc
DOWN  UP  TOP   PORT
```

↓

```
STATUS/MX/METER--P00
battery          vdc
voltage
DOWN  UP  TOP   PORT
```

↓

```
STATUS/MX/METER--P00
panel            vdc
voltage
DOWN  UP  TOP   PORT
```

↓

```
STATUS/MX/METER-----
end of meter menu

      UP  TOP STATUS
```

SETPOINTS

```
MAIN----------------
      6:54:42PM

SUM STATUS SETUP ADV
```

↓

```
STATUS--------------
choose product:

FX   MX
```

↓

```
STATUS/MX-----------
choose category:

MODE METER SETP MAIN
```

↓

```
STATUS/MX/SETP---P00
absorb           vdc
voltage
DOWN     STATUS PORT
```

↓

```
STATUS/MX/SETP---P00
float            vdc
voltage
DOWN  UP  TOP   PORT
```

↓

```
STATUS/MX/SETP------
end of setpoint menu

      UP  TOP STATUS
```

MAIN MENU SHORTCUT

Pressing the left two keys on the MATE at the same time from anywhere in the menu system takes you to the MAIN menu

SETUP MENU--FX

SEARCH

```
MAIN----------------
      6:54:42P

SUM STATUS SETUP ADV
```
↓
```
SETUP---------------
choose product:

FX              MATE
```
↓
```
SETUP/FX------------
choose category:

SRCH INPUT      MAIN
```
↓
```
SETUP/FX/SEARCH—-P00
search             0
sensitivity
DOWN  INC  DEC  PORT
```
↓
```
SETUP/FX/SEARCH—-P00
search      2 cycles
pulse length
DOWN  INC  DEC  PORT
```
↓
```
SETUP/FX/SEARCH—-P00
search     30 cycles
pulse spacing
DOWN  INC  DEC  PORT
```
↓
```
SETUP/FX/SEARCH-----
    search setup
      completed
       TOP SETUP MAIN
```

INPUT

```
MAIN----------------
      6:54:42P

SUM STATUS SETUP ADV
```
↓
```
SETUP---------------
choose product:

FX              MATE
```
↓
```
SETUP/FX------------
choose category:

SRCH INPUT      MAIN
```
↓
```
SETUP/FX/INPUT---P00
ac transfer     GRID
control
DOWN  GRID GEN  PORT
```
↓
```
SETUP/FX/INPUT---P00
ac1/grid      60 aac
limit
DOWN  INC  DEC  PORT
```
↓
```
SETUP/FX/INPUT---P00
ac2/gen       30 aac
limit
DOWN  INC  DEC  PORT
```
↓
```
SETUP/FX/INPUT------
     input setup
      completed
     TOP  SETUP MAIN
```

MAIN MENU SHORTCUT

Pressing the left two keys on the MATE at the same time from anywhere in the menu system takes you to the MAIN menu

SETUP MENU--MATE

MATE

```
MAIN----------------
6:54:42P

SUM STATUS SETUP ADV
```
↓
```
SETUP---------------
choose product:

FX              MATE
```
↓
```
SETUP/MATE/PAGE1----
choose category:

CLOCK CNT GLOW PAGE2
```
↓
```
SETUP/MATE/PAGE2----
choose category:

PG1 SUMRY COMM  MAIN
```

DATE / TIME

```
SETUP/MATE/PAGE1----
choose category:

CLOCK CNT GLOW PAGE2
```
↓
```
SETUP/MATE/CLOCK----
  Tu 12/10/02
     4:00:22P
BACK DATE  TIME
```

CONTRAST

```
SETUP/MATE/PAGE1----
choose category:

CLOCK CNT GLOW PAGE2
```
↓
```
SETUP/MATE/CNT------
contrast:        30%

BACK  INC  DEC
```

BACKLIGHT

```
SETUP/MATE/PAGE1----
choose category:

CLOCK CNT GLOW PAGE2
```
↓
```
SETUP/MATE/GLOW----
Backlight controls

BACK LEVEL MODE TIME
```

SETUP MENU--MATE

SUMMARY

```
SETUP/MATE/PAGE1----
choose category:

CLOCK  CNT  GLOW PG2
```

```
SETUP/MATE/PAGE2----
choose category:

PG1 SUMRY COMM  MAIN
```

```
SETUP/MATE/SUMMARY--
summary controls

BACK TYPE TIME MAIN
```

COMM

```
SETUP/MATE/PAGE1----
choose category:

CLOCK  CNT  GLOW PG2
```

```
SETUP/MATE/PAGE2----
choose category:

PG1 SUMRY COMM  MAIN
```

```
SETUP/MATE/COMM-----
choose category:

BACK REPOLL PC DEBUG
```

MAIN MENU SHORTCUT

Pressing the left two keys on the MATE at the same time from anywhere in the menu system takes you to the MAIN menu

ADVANCED MENU--FX

INVERTER

```
MAIN----------------
      6:54:42P

SUM STATUS SETUP ADV
```

```
ADV/SETTINGS/WARNING
changes made could
adversely effect
system performance
```

```
ADV/PASSWORD--------
 enter the password:
        132
ENTER INC  DEC  EXIT
```

```
ADV-----------------
choose product:

FX   MX  MATE   MAIN
```

```
ADV/FX/PAGE1--------
choose category:

ADV  INV  CHGR   PG2
```

```
ADV/FX/INVERTER—-P00
search             6
sensitivity
DOWN  INC  DEC  PORT
```

```
ADV/FX/INVERTER—-P00
search       2 cycles
pulse length
DOWN  INC  DEC  PORT
```

```
ADV/FX/INVERTER—-P00
search      30 cycles
pulse spacing
DOWN  INC  DEC  PORT
```

INVERTER cont

```
ADV/FX/INVERTER—-P00
low battery 21.0 vdc
cut-out setpoint
DOWN  INC  DEC  PORT
```

```
ADV/FX/INVERTER—-P00
low battery 25.0 vdc
cut-in setpoint
DOWN  INC  DEC  PORT
```

```
ADV/FX/INVERTER—-P00
adjust        120 vac
output voltage
DOWN  INC  DEC  PORT
```

```
ADV/FX/INVERTER—----
reset FX to factory
defaults
DOWN            MORE
```

```
ADV/FX/INVERTER—-P00
choose FX port
then press next
EXIT       PORT NEXT
```

```
ADV/FX/INVERTER—-P00
press button 1
               READY
EXIT  1    2
```

```
ADV/FX/INVERTER—-P00
press button 2
               READY
EXIT  1    2
```

```
ADV/FX/INVERTER—-P00
press button 1
                DONE
EXIT  1    2
```

INVERTER cont

```
ADV/FX/INVERTER—----
reset FX to factory
defaults
DOWN            MORE
```

```
ADV/FX/INVERTER—----
Inverter programming
      completed
      TOP  ADV  MAIN
```

CHARGER

```
MAIN----------------
      6:54:42P

SUM STATUS SETUP ADV
```

```
ADV/SETTINGS/WARNING
changes made could
adversely effect
system performance
```

```
ADV/PASSWORD--------
 enter the password:
        132
ENTER INC  DEC  EXIT
```

```
ADV-----------------
choose product:

FX   MX  MATE   MAIN
```

```
ADV/FX/PAGE1--------
choose category:

ADV  INV  CHGR   PG2
```

cont. on next page

CHARGER cont

```
ADV/FX/CHARGER---P00
charger     12.0 aac
limit
DOWN  INC  DEC  PORT
```

```
ADV/FX/CHARGER------
absorb      28.8 vdc
setpoint
DOWN  INC  DEC  PORT
```

```
ADV/FX/CHARGER---P00
absorb      02.0 hrs
time limit
DOWN  INC  DEC  PORT
```

```
ADV/FX/CHARGER---P00
float       26.8 vdc
setpoint
DOWN  INC  DEC  PORT
```

```
ADV/FX/CHARGER---P00
float       00.5 hrs
time period
DOWN  INC  DEC  PORT
```

```
ADV/FX/CHARGER---P00
refloat     25.0 vdc
setpoint
DOWN  INC  DEC  PORT
```

```
ADV/FX/CHARGER---P00
equalize    28.8 vdc
setpoint
DOWN  INC  DEC  PORT
```

```
ADV/FX/CHARGER---P00
equalize    02.0 hrs
time period
DOWN  INC  DEC  PORT
```

```
ADV/FX/CHARGER------
Charger programming
        compelted
        TOP ADV  MAIN
```

GRID

```
MAIN----------------
       6:54:42P

SUM STATUS SETUP ADV
```

```
ADV/SETTINGS/WARNING
changes made could
adversely effect
system performance
```

```
ADV/PASSWORD--------
 enter the password:
        132
ENTER INC  DEC  EXIT
```

```
ADV-----------------
choose product:

FX   MX  MATE   MAIN
```

```
ADV/FX/PAGE1--------
choose category:

ADV  INV  CHGR   PG2
```

```
ADV/FX/PAGE2--------
choose category:

ADV  GRID  GEN   PG2
```

```
ADV/FX/GRID------P00
ac input    00.5 min
connect delay
DOWN  INC  DEC  PORT
```

```
ADV/FX/GRID------P00
ac1/grid     100 vac
lower limit
DOWN  INC  DEC  PORT
```

```
ADV/FX/GRID------P00
ac1/grid     140 vac
upper limit
DOWN  INC  DEC  PORT
```

```
ADV/FX/GRID------P00
ac1/grid    60.0 aac
input limit
DOWN  INC  DEC  PORT
```

```
ADV/FX/GRID------P00
ac1/grid    3 cycles
transfer delay
DOWN  INC  DEC  PORT
```

```
ADV/FX/GRID------P00
ac1/grid          ON
hot standby
DOWN  OFF  ON  PORT
```

```
ADV/FX/GRID---------
GRID programming
       completed
       TOP  ADV  MAIN
```

GEN

```
MAIN----------------
       6:54:42P

SUM STATUS SETUP ADV
```

```
ADV/SETTINGS/WARNING
changes made could
adversely effect
system performance
```

```
ADV/PASSWORD--------
 enter the password:
        132
ENTER INC  DEC  EXIT
```

```
ADV-----------------
choose product:

FX   MX  MATE   MAIN
```

```
ADV/FX/PAGE1--------
choose category:

ADV  INV  CHGR   PG2
```

```
ADV/FX/PAGE2--------
choose category:

PG1  GRID  GEN   PG3
```

```
ADV/FX/GEN-------P00
ac input    00.5 min
connect delay
DOWN  INC  DEC  PORT
```

```
ADV/FX/GEN-------P00
ac2/gen      100 vac
lower limit
DOWN  INC  DEC  PORT
```

```
ADV/FX/GEN-------P00
ac2/gen      140 vac
upper limit
DOWN  INC  DEC  PORT
```

```
ADV/FX/GEN-------P00
ac2/gen     60.0 aac
input limit
DOWN  INC  DEC  PORT
```

```
ADV/FX/GEN-------P00
ac2/gen     3 cycles
transfer delay
DOWN  INC  DEC  PORT
```

```
ADV/FX/GEN-------P00
ac2/gen          OFF
support
DOWN  OFF  ON  PORT
```

```
ADV/FX/GEN----------
GEN programming
      completed
      TOP  ADV  MAIN
```

AUX OUTPUT

```
MAIN----------------
       6:54:42P

SUM STATUS SETUP ADV
```

```
ADV/SETTINGS/WARNING
changes made could
adversely effect
system performance
```

```
ADV/PASSWORD--------
 enter the password:
        132
ENTER INC  DEC  EXIT
```

```
ADV-----------------
choose product:

FX   MX  MATE   MAIN
```

```
ADV/FX/PAGE1--------
choose category:

ADV  INV  CHGR   PG2
```

```
ADV/FX/PAGE2--------
choose category:

PG1  GRID  GEN   PG3
```

cont on next page

AUX OUTPUT cont

```
ADV/FX/PAGE3--------
choose category:

PG2  AUX  STACK  PG4
```

```
ADV/FX/AUX-------P00
aux output      OFF
control
DOWN  INC  DEC  PORT
```

```
ADV/FX/AUX-------P00
aux output     AUTO
control
DOWN  INC  DEC  PORT
```

```
ADV/FX/AUX-------P00
aux output       ON
control
DOWN  INC  DEC  PORT
```

```
ADV/FX/AUX-------P00
aux output  Remote
function
DOWN  INC  DEC  PORT
```

```
ADV/FX/AUX-------P00
aux output  Loadshed
function
DOWN  INC  DEC  PORT
```

```
ADV/FX/AUX-------P00
aux output  GenAlert
function
DOWN  INC  DEC  PORT
```

```
ADV/FX/AUX-------P00
aux output   Fault
function
DOWN  INC  DEC  PORT
```

```
ADV/FX/AUX-------P00
aux output  Vent Fan
function
DOWN  INC  DEC  PORT
```

```
ADV/FX/AUX-------P00
aux output  CoolFan
function
DOWN  INC  DEC  PORT
```

```
ADV/FX/AUX-------P00
aux output  DivertDC
function
DOWN  INC  DEC  PORT
```

```
ADV/FX/AUX-------P00
aux output  DivertAC
function
DOWN  INC  DEC  PORT
```

```
ADV/FX/AUX-------P00
genalert    22.0 vdc
on setpoint
DOWN  INC  DEC  PORT
```

```
ADV/FX/AUX-------P00
genalert       4 min
on delay
DOWN  INC  DEC  PORT
```

```
ADV/FX/AUX-------P00
genalert    28.0 vdc
off setpoint
DOWN  INC  DEC  PORT
```

```
ADV/FX/AUX-------P00
genalert       9 min
off delay
DOWN  INC  DEC  PORT
```

```
ADV/FX/AUX-------P00
loadshed    22.0 vdc
off setpoint
DOWN  INC  DEC  PORT
```

```
ADV/FX/AUX-------P00
ventfan     26.0 vdc
on setpoint
DOWN  INC  DEC  PORT
```

```
ADV/FX/AUX-------P00
ventfan off    5 min
period
DOWN  INC  DEC  PORT
```

```
ADV/FX/AUX-------P00
diversion   29.2 vdc
on setpoint
DOWN  INC  DEC  PORT
```

```
ADV/FX/AUX-------P00
diversion     30 sec
off delay
DOWN  INC  DEC  PORT
```

```
ADV/FX/AUX---------
   Aux output
  Setup completed
      TOP  ADV  MAIN
```

STACKING

```
MAIN----------------
      6:54:42P

SUM STATUS SETUP ADV
```

```
ADV/SETTINGS/WARNING
changes made could
adversely effect
system performance
```

```
ADV/PASSWORD--------
 enter the password:
        132
ENTER INC  DEC  EXIT
```

```
ADV-----------------
choose product:

FX   MX  MATE   MAIN
```

```
ADV/FX/PAGE1--------
choose category:

ADV  INV  CHGR   PG2
```

```
ADV/FX/PAGE2--------
choose category:

PG1  GRID  GEN   PG3
```

```
ADV/FX/PAGE3--------
choose category:

PG2  AUX  STACK  PG4
```

STACKING cont

```
ADV/FX/STACK-----P00
stack   1-2PH Master
phase
DOWN  INC  DEC  PORT
```

```
ADV/FX/STACK-----P00
stack   Clasic Slave
phase
DOWN  INC  DEC  PORT
```

```
ADV/FX/STACK-----P00
stack   OB Slave L1
phase
DOWN  INC  DEC  PORT
```

```
ADV/FX/STACK-----P00
stack   OB Slave L2
phase
DOWN  INC  DEC  PORT
```

```
ADV/FX/STACK-----P00
stack   3PH Master
phase
DOWN  INC  DEC  PORT
```

```
ADV/FX/STACK-----P00
stack   3PH Slave
phase
DOWN  INC  DEC  PORT
```

```
ADV/FX/STACK-----P00
power save level   0
master adjust only
DOWN  INC  DEC  PORT
```

```
ADV/FX/STACK-----P00
power save level   1
slave adjust only
DOWN  INC  DEC  PORT
```

```
ADV/FX/STACK--------
  Stacking setup
       completed
      TOP  ADV  MAIN
```

SELL

```
MAIN----------------
      6:54:42P

SUM STATUS SETUP ADV
                   ↓
ADV/SETTINGS/WARNING
changes made could
adversely effect
system performance
 ↓     ↓     ↓     ↓
ADV/PASSWORD--------
 enter the password:
       132
ENTER INC  DEC  EXIT
 ↓
ADV-----------------
choose product:

FX   MX  MATE   MAIN
 ↓
ADV/FX/PAGE1--------
choose category:

ADV  INV  CHGR   PG2
                   ↓
ADV/FX/PAGE2--------
choose category:

PG1  GRID  GEN   PG3
                   ↓
ADV/FX/PAGE3--------
choose category:

PG2  AUX  STACK  PG4
                   ↓
ADV/FX/PAGE4--------
choose category:

PG3  SELL  CAL  MAIN
      ↓
ADV/FX/SELL------P00
Sell re     23.6 vdc
volts
DOWN  INC  DEC  PORT
  ↓
ADV/FX/SELL------P00
Grid tie        IEEE
window
DOWN  IEEE USER PORT
  ↓
ADV/FX/SELL------P00
Grid tie        ---
authority
DOWN  INC  DEC  PORT
  ↓
ADV/FX/SELL------P00
Sell enable      OFF

DOWN  OFF  ON   PORT
  ↓
ADV/FX/SELL------P00
 Selling setup
      Completed
      TOP  ADV  MAIN
```

CAL

```
MAIN----------------
      6:54:42P

SUM STATUS SETUP ADV
                   ↓
ADV/SETTINGS/WARNING
changes made could
adversely effect
system performance
 ↓     ↓     ↓     ↓
ADV/PASSWORD--------
 enter the password:
       132
ENTER INC  DEC  EXIT
 ↓
ADV-----------------
choose product:

FX   MX  MATE   MAIN
 ↓
ADV/FX/PAGE1--------
choose category:

ADV  INV  CHGR   PG2
                   ↓
ADV/FX/PAGE2--------
choose category:

PG1  GRID  GEN   PG3
                   ↓
ADV/FX/PAGE3--------
choose category:

PG2  AUX  STACK  PG4
                   ↓
ADV/FX/PAGE4--------
choose category:

PG3  SELL  CAL  MAIN
            ↓
ADV/FX/CALIBRATE-P00
Vac input    120 vac
adjustment
DOWN  INC  DEC  PORT
  ↓
ADV/FX/CALIBRATE-P00
Vac output   120 vac
adjustment
DOWN  INC  DEC  PORT
  ↓
ADV/FX/CALIBRATE-P00
Battery vdc 25.4 vdc
adjustment
DOWN  INC  DEC  PORT
  ↓
ADV/FX/CALIBRATE----
 Calibration setup
      completed
      TOP  ADV  MAIN
```

MAIN MENU SHORTCUT

Pressing the left two keys on the MATE at the same time from anywhere in the menu system takes you to the MAIN menu

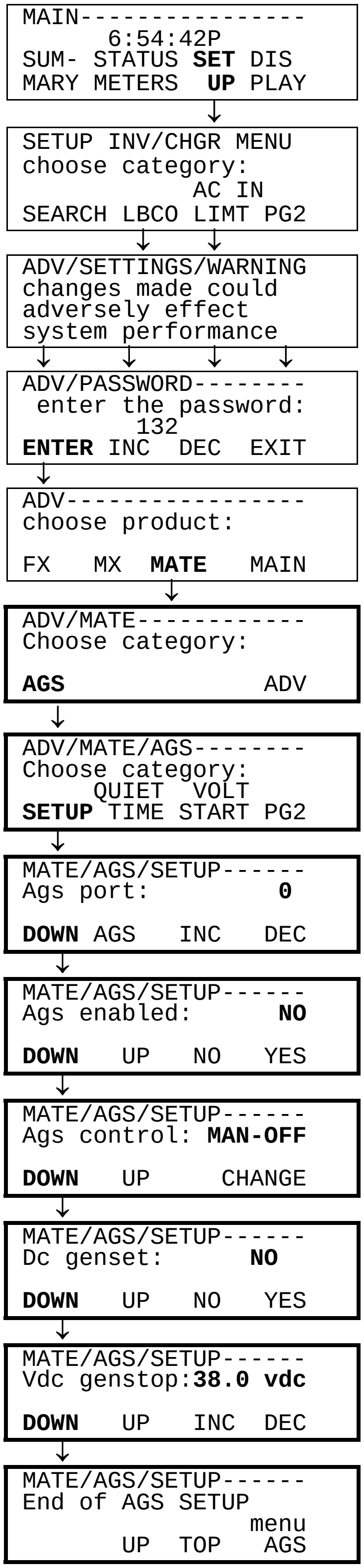
AUX

```
MAIN----------------
       6:54:42P

SUM STATUS SETUP ADV
                   ↓
ADV/SETTINGS/WARNING
changes made could
adversely effect
system performance
  ↓     ↓     ↓    ↓
ADV/PASSWORD--------
 enter the password:
        132
ENTER INC  DEC  EXIT
  ↓

ADV-----------------
choose product:

FX   MX  MATE   MAIN
      ↓
ADV/MX----------------
choose category:

AUX           ADV  MAIN
 ↓
ADV/MX/AUX---------P00
Aux output    Disabled
function
DOWN              PORT
  ↓
ADV/MX/AUX-------P00
Aux output       Off
control
DOWN  ON   OFF  PORT
  ↓
ADV/MX/AUX----------
End of aux menu

        TOP ADV MAIN
```

MAIN MENU SHORTCUT

Pressing the left two keys on the MATE at the same time from anywhere in the menu system takes you to the MAIN menu

AGS SETUP



```
MAIN----------------
      6:54:42P
SUM- STATUS SET DIS
MARY METERS  UP PLAY
```

```
SETUP INV/CHGR MENU
choose category:
            AC IN
SEARCH LBCO LIMT PG2
```

```
ADV/SETTINGS/WARNING
changes made could
adversely effect
system performance
```

```
ADV/PASSWORD--------
 enter the password:
       132
ENTER INC  DEC  EXIT
```

```
ADV-----------------
choose product:

FX   MX  MATE   MAIN
```

```
ADV/MATE------------
Choose category:

AGS              ADV
```

```
ADV/MATE/AGS--------
Choose category:
     QUIET  VOLT
SETUP TIME START PG2
```

```
MATE/AGS/SETUP------
Ags port:          0

DOWN AGS   INC   DEC
```

```
MATE/AGS/SETUP------
Ags enabled:      NO

DOWN   UP   NO   YES
```

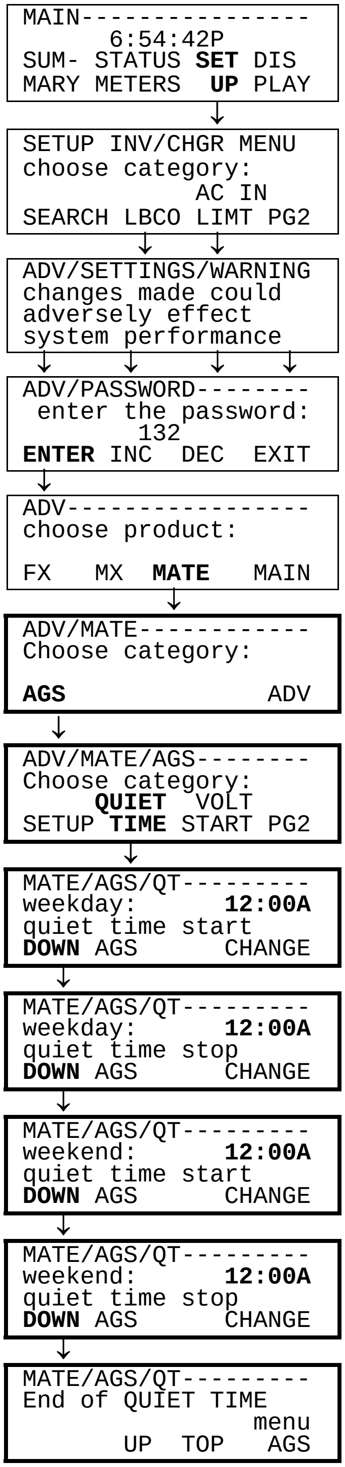
```
MATE/AGS/SETUP------
Ags control: MAN-OFF

DOWN   UP     CHANGE
```

```
MATE/AGS/SETUP------
Dc genset:      NO

DOWN   UP   NO   YES
```

```
MATE/AGS/SETUP------
Vdc genstop:38.0 vdc

DOWN   UP   INC  DEC
```

```
MATE/AGS/SETUP------
End of AGS SETUP
                menu
       UP  TOP   AGS
```

QUIET TIME



```
MAIN----------------
      6:54:42P
SUM- STATUS SET DIS
MARY METERS  UP PLAY
```

```
SETUP INV/CHGR MENU
choose category:
            AC IN
SEARCH LBCO LIMT PG2
```

```
ADV/SETTINGS/WARNING
changes made could
adversely effect
system performance
```

```
ADV/PASSWORD--------
 enter the password:
       132
ENTER INC  DEC  EXIT
```

```
ADV-----------------
choose product:

FX   MX  MATE   MAIN
```

```
ADV/MATE------------
Choose category:

AGS              ADV
```

```
ADV/MATE/AGS--------
Choose category:
     QUIET  VOLT
SETUP TIME START PG2
```

```
MATE/AGS/QT---------
weekday:      12:00A
quiet time start
DOWN AGS      CHANGE
```

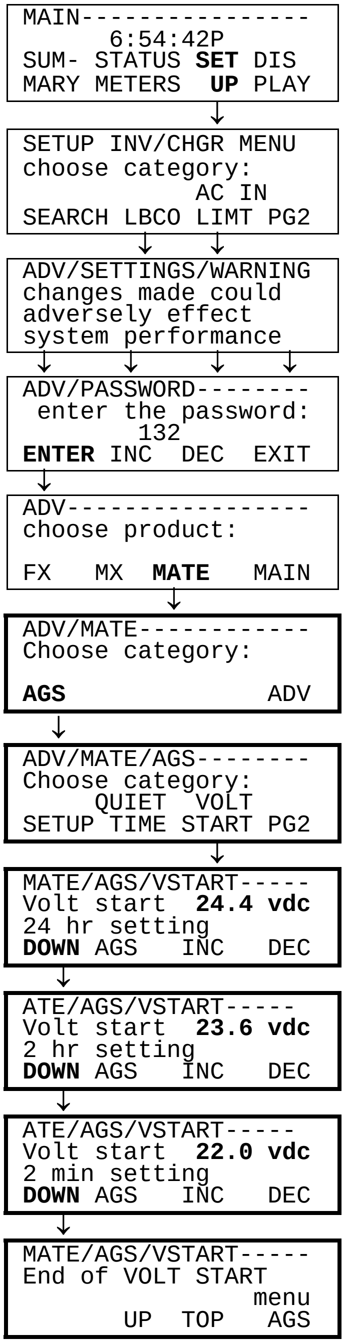
```
MATE/AGS/QT---------
weekday:      12:00A
quiet time stop
DOWN AGS      CHANGE
```

```
MATE/AGS/QT---------
weekend:      12:00A
quiet time start
DOWN AGS      CHANGE
```

```
MATE/AGS/QT---------
weekend:      12:00A
quiet time stop
DOWN AGS      CHANGE
```

```
MATE/AGS/QT---------
End of QUIET TIME
                menu
       UP  TOP   AGS
```

VOLTAGE START



```
MAIN----------------
      6:54:42P
SUM- STATUS SET DIS
MARY METERS  UP PLAY
```

```
SETUP INV/CHGR MENU
choose category:
            AC IN
SEARCH LBCO LIMT PG2
```

```
ADV/SETTINGS/WARNING
changes made could
adversely effect
system performance
```

```
ADV/PASSWORD--------
 enter the password:
       132
ENTER INC  DEC  EXIT
```

```
ADV-----------------
choose product:

FX   MX  MATE   MAIN
```

```
ADV/MATE------------
Choose category:

AGS              ADV
```

```
ADV/MATE/AGS--------
Choose category:
     QUIET  VOLT
SETUP TIME START PG2
```

```
MATE/AGS/VSTART-----
Volt start  24.4 vdc
24 hr setting
DOWN AGS   INC   DEC
```

```
ATE/AGS/VSTART-----
Volt start  23.6 vdc
2 hr setting
DOWN AGS   INC   DEC
```

```
ATE/AGS/VSTART-----
Volt start  22.0 vdc
2 min setting
DOWN AGS   INC   DEC
```

```
MATE/AGS/VSTART-----
End of VOLT START
                menu
       UP  TOP   AGS
```

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LOAD START

```
MAIN----------------
      6:54:42P
SUM- STATUS SET DIS
MARY METERS  UP PLAY
```

```
SETUP INV/CHGR MENU
choose category:
            AC IN
SEARCH LBCO LIMT PG2
```

```
ADV/SETTINGS/WARNING
changes made could
adversely effect
system performance
```

```
ADV/PASSWORD--------
 enter the password:
       132
ENTER INC  DEC  EXIT
```

```
ADV-----------------
choose product:

FX   MX  MATE   MAIN
```

```
ADV/MATE------------
Choose category:

AGS              ADV
```

```
ADV/MATE/AGS/PG2----
Choose category:
     QUIET  VOLT
SETUP TIME START PG2
```

```
ADV/MATE/AGS--------
Choose category:
     LOAD   MUST
PG2  START  RUN  PG3
```

```
ADV/MATE/AGS/LS-----
load start      0 kw

DOWN AGS   INC   DEC
```

```
ADV/MATE/AGS/LS-----
load start     1 min
selay
DOWN  UP   INC   DEC
```

```
ADV/MATE/AGS/LS-----
load stop      0 kw

DOWN  UP   INC   DEC
```

```
ADV/MATE/AGS/LS-----
load sop      1 min
selay
DOWN  UP   INC   DEC
```

```
ADV/MATE/AGS/LS-----
End of LOAD START
                menu
        UP  TOP  AGS
```

MUST RUN

```
MAIN----------------
      6:54:42P
SUM- STATUS SET DIS
MARY METERS  UP PLAY
```

```
SETUP INV/CHGR MENU
choose category:
            AC IN
SEARCH LBCO LIMT PG2
```

```
ADV/SETTINGS/WARNING
changes made could
adversely effect
system performance
```

```
ADV/PASSWORD--------
 enter the password:
       132
ENTER INC  DEC  EXIT
```

```
ADV-----------------
choose product:

FX   MX  MATE   MAIN
```

```
ADV/MATE------------
Choose category:

AGS              ADV
```

```
ADV/MATE/AGS/PG2----
Choose category:
     QUIET  VOLT
SETUP TIME START PG2
```

```
ADV/MATE/AGS--------
Choose category:
     LOAD   MUST
PG2  START  RUN  PG3
```

```
ADV/MATE/AGS/MR-----
weekday:      12:00A
must run start time
DOWN AGS      CHANGE
```

```
ADV/MATE/AGS/MR-----
weekday:      12:00A
must run stop time
DOWN  UP      CHANGE
```

```
ADV/MATE/AGS/MR-----
weekend:      12:00A
must run start time
DOWN  UP      CHANGE
```

```
ADV/MATE/AGS/MR-----
weekend:      12:00A
must run stop time
DOWN  UP      CHANGE
```

```
ADV/MATE/AGS/MR-----
End of MUST RUN
                menu
        UP  TOP  AGS
```

EXERCISE

```
MAIN----------------
      6:54:42P
SUM- STATUS SET DIS
MARY METERS  UP PLAY
```

```
SETUP INV/CHGR MENU
choose category:
            AC IN
SEARCH LBCO LIMT PG2
```

```
ADV/SETTINGS/WARNING
changes made could
adversely effect
system performance
```

```
ADV/PASSWORD--------
 enter the password:
       132
ENTER INC  DEC  EXIT
```

```
ADV-----------------
choose product:

FX   MX  MATE   MAIN
```

```
ADV/MATE------------
Choose category:

AGS              ADV
```

```
ADV/MATE/AGS/PG2----
Choose category:
     QUIET  VOLT
SETUP TIME START PG2
```

```
ADV/MATE/AGS--------
Choose category:
     LOAD   MUST
PG2  START  RUN  PG3
```

```
ADV/MATE/AGS--------
Choose category:

PG3 EXERCISE TMRS
      ADV
```

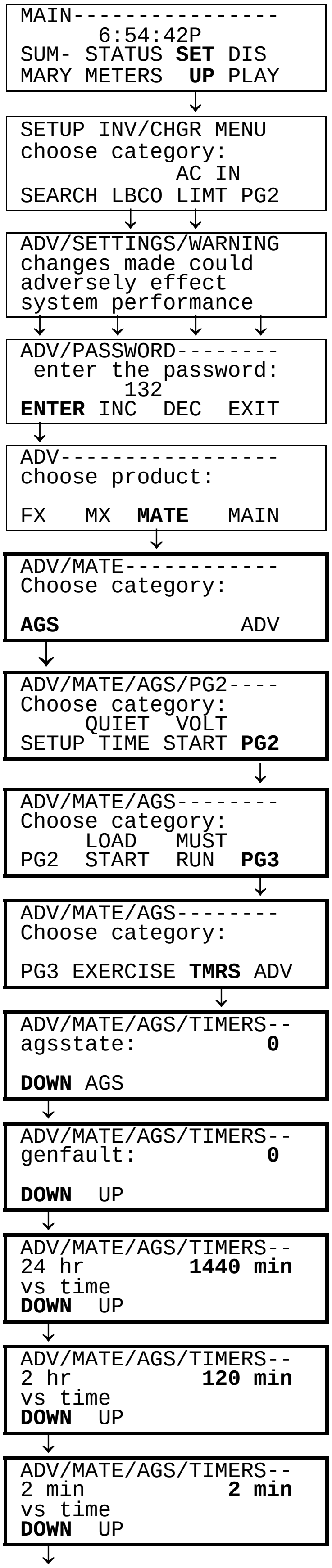
```
ADV/MATE/AGS/EX-----
Exercise          --
start day
DOWN AGS   INC   DEC
```

```
ADV/MATE/AGS/EX-----
exercise      12:00A
start time
DOWN  UP      CHANGE
```

```
ADV/MATE/AGS/EX-----
Exercise        15
      min
period
DOWN AGS   INC   DEC
```

```
ADV/MATE/AGS/EX-----
End of EXERCISE
                menu
        UP  TOP  AGS
```

TIMERS



```
MAIN----------------
      6:54:42P
SUM- STATUS SET DIS
MARY METERS  UP PLAY
```

```
SETUP INV/CHGR MENU
choose category:
            AC IN
SEARCH LBCO LIMT PG2
```

```
ADV/SETTINGS/WARNING
changes made could
adversely effect
system performance
```

```
ADV/PASSWORD--------
 enter the password:
        132
ENTER INC  DEC  EXIT
```

```
ADV-----------------
choose product:

FX   MX  MATE   MAIN
```

```
ADV/MATE------------
Choose category:

AGS                ADV
```

```
ADV/MATE/AGS/PG2----
Choose category:
     QUIET  VOLT
SETUP TIME START PG2
```

```
ADV/MATE/AGS--------
Choose category:
     LOAD   MUST
PG2  START  RUN  PG3
```

```
ADV/MATE/AGS--------
Choose category:

PG3 EXERCISE TMRS ADV
```

```
ADV/MATE/AGS/TIMERS--
agsstate:          0

DOWN AGS
```

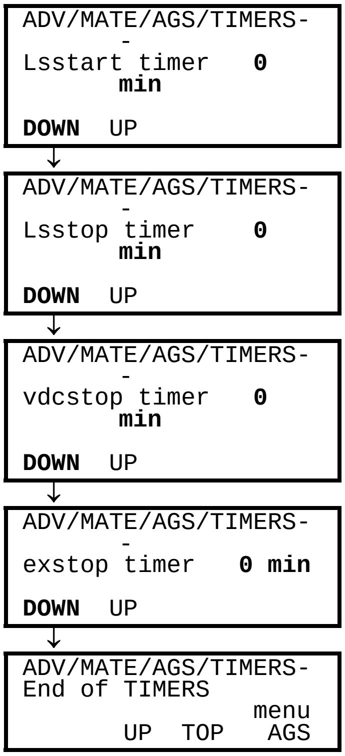
```
ADV/MATE/AGS/TIMERS--
genfault:          0

DOWN  UP
```

```
ADV/MATE/AGS/TIMERS--
24 hr         1440 min
vs time
DOWN  UP
```

```
ADV/MATE/AGS/TIMERS--
2 hr           120 min
vs time
DOWN  UP
```

```
ADV/MATE/AGS/TIMERS--
2 min            2 min
vs time
DOWN  UP
```

TIMERS cont.



```
ADV/MATE/AGS/TIMERS-
       -
Lsstart timer   0
      min

DOWN  UP
```

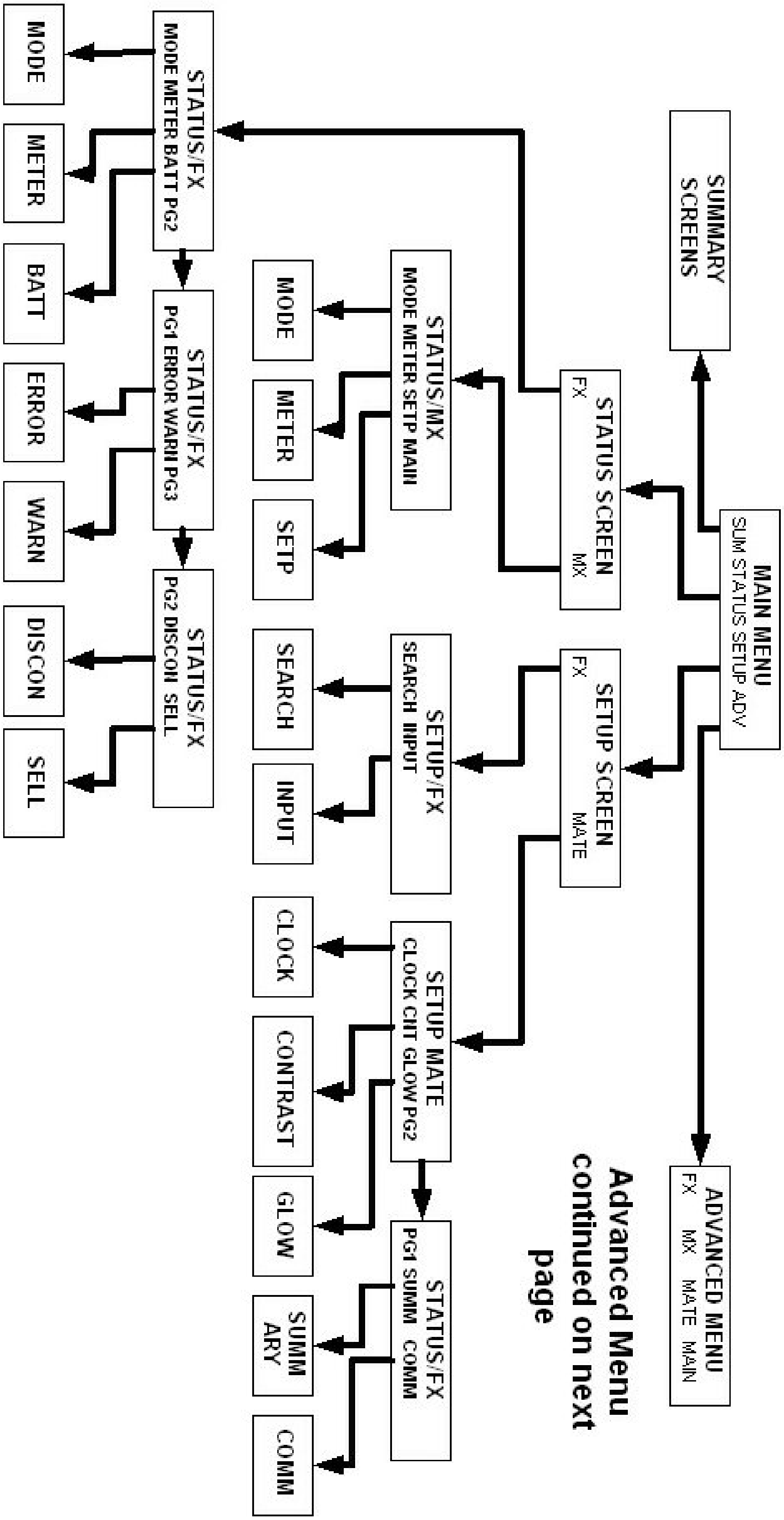
```
ADV/MATE/AGS/TIMERS-
       -
Lsstop timer    0
      min

DOWN  UP
```

```
ADV/MATE/AGS/TIMERS-
       -
vdcstop timer   0
      min

DOWN  UP
```

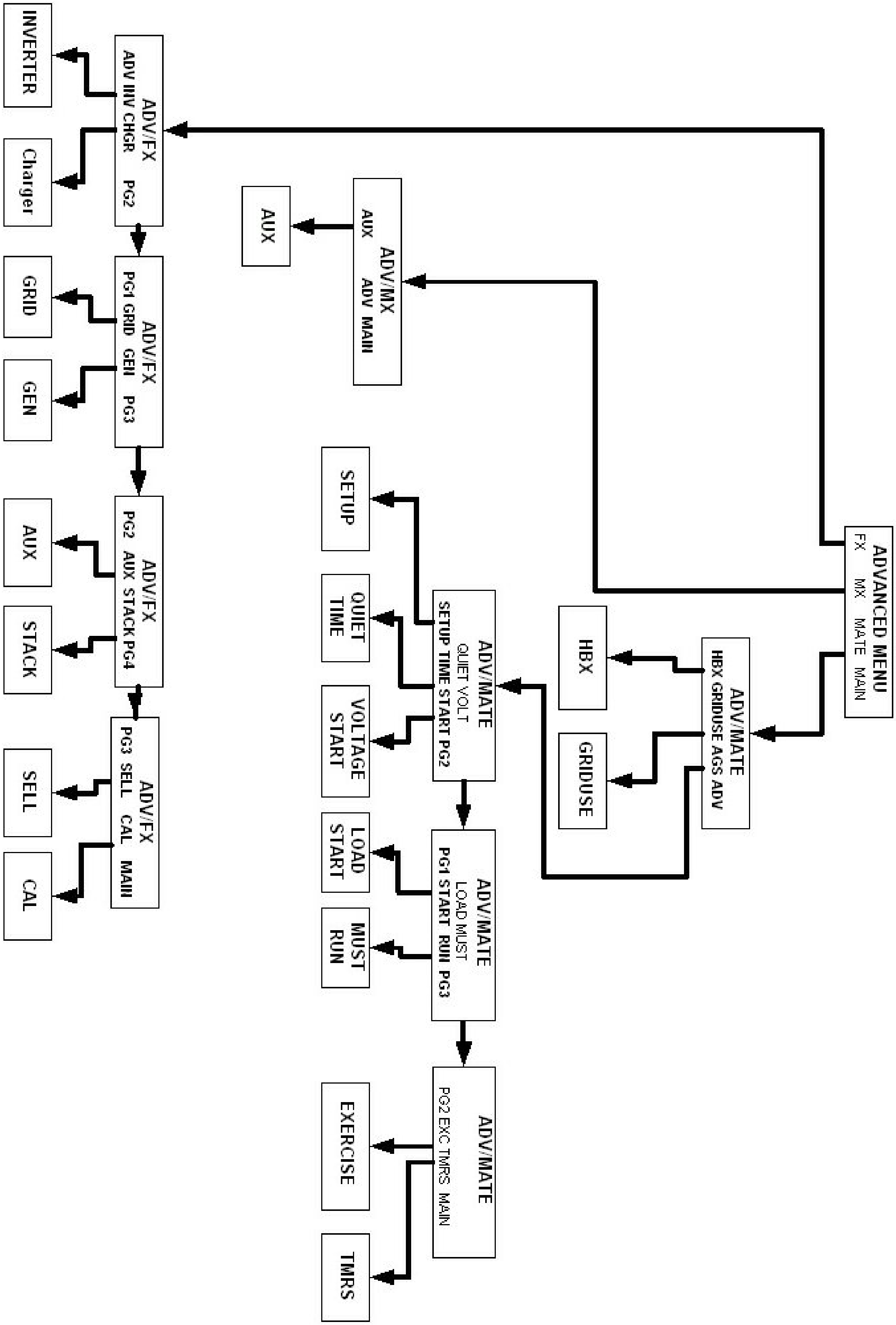
```
ADV/MATE/AGS/TIMERS-
       -
exstop timer   0 min

DOWN  UP
```

```
ADV/MATE/AGS/TIMERS-
End of TIMERS
                menu
       UP  TOP   AGS
```

6.0 Menu Map Overview


MAIN MENU
SUM STATUS SETUP ADV
SUMMARY SCREENS
STATUS SCREEN
FX MX
SETUP SCREEN
FX MATE
ADVANCED MENU
FX MX MATE MAIN
STATUS/FX
MODE METER BATT PG2
MODE
METER
BATT
STATUS/FX
PG1 ERROR WARN PG3
ERROR
WARN
STATUS/FX
PG2 DISCON SELL
DISCON
SELL
STATUS/MX
MODE METER SETP MAIN
MODE
METER
SETP
SETUP/FX
SEARCH INPUT
SEARCH
INPUT
SETUP MATE
CLOCK CNT GLOW PG2
CLOCK
CONTRAST
GLOW
STATUS/FX
PG1 SUMM COMM
SUMM ARY
COMM

Advanced Menu continued on next page


ADVANCED MENU
FX MX MATE MAIN
ADV/FX
ADV INV CHGR PG2
INVERTER
Charger
ADV/FX
PG1 GRID GEN PG3
GRID
GEN
ADV/FX
PG2 AUX STACK PG4
AUX
STACK
ADV/FX
PG3 SELL CAL MAIN
SELL
CAL
ADV/MX
AUX ADV MAIN
AUX
ADV/MATE
HBX GRIDUSE AGS ADV
HBX
GRIDUSE
ADV/MATE
QUIET VOLT
SETUP TIME START PG2
SETUP
QUIET TIME
VOLTAGE START
ADV/MATE
LOAD MUST
PG1 START RUN PG3
LOAD START
MUST RUN
ADV/MATE
PG2 EXC TMRS MAIN
EXERCISE
TMRS

7.0 Troubleshooting

MATE does not power-up

The OutBack MATE is powered by the OutBack product that it is connected to. Make sure that all OutBack Products are powered-up and operating correctly before connecting the MATE. Check or replace the CAT5 cables running from the MATE to the OutBack product.

MATE does not find a Device

Make sure that all OutBack Products are powered-up and operating correctly before connecting the MATE. Check or replace the CAT5 cables running from the MATE to the OutBack product.

If a HUB is being used, make sure no OutBack products have been moved, unplugged, or added. If they have, follow the instructions in MATE Setup Communications Options to REPOLL for moved or new devices.

MATE does not display the correct meter or setting.

Make sure that all OutBack Products are powered-up and operating correctly before connecting the MATE. Check or replace the CAT5 cables running from the MATE to the OutBack product.

If a HUB is being used, make sure no OutBack products have been moved or unplugged. If they have, follow the instructions in MATE Setup Communications Options to REPOLL for moved or new devices.

MATE will not EQ my system when I use the EQ function under the <ACIN> button.

Older FXs and MXs with a newer MATE will not be able to utilize this system wide command. FXs that do not respond to this command can have an EQ cycle started by using the EQ start function located in the STATUS/FX/MODE menu. From the Main screen press **<STATUS>, <FX>**, **<MODES>**. Continue to press **<DOWN>** until you see the EQ function. If a HUB is used, FXs must have an EQ cycle start individually for each FX on the HUB (Use the <PORT> button to cycle through the available FXs).

MATE displays a 'COMM ERROR'

If the MATE receives too many interrupted or corrupt communications with OutBack products attached to the HUB, it will display a 'COMM ERROR' screen.

Choosing 'VIEW DEBUG' takes you to a screen that lists all ports and accumulated errors. Any Port experiencing errors can be found by the error count after the Port number.

In the example to the right, Port 4 has a large number of errors detected (04:025 means Port 4: showing 25 errors).

```
00:000    01:000    02:000
03:000    04:025    05:000
06:000    07:000    08:000
09:000    10:000    2M:000
```

Pressing any key will take you to the SETUP/MATE/COMM screen, which will allow the error counts to be reset using the 'RSET' button, the Debug screen can be redisplayed by using the 'VIEW' button, or user can get back to the SETUP menu by using the 'BACK' button.

Use the information on the Debug screen to locate the problem device. Make sure that it's DC breaker in on, and that is operating correctly. Check or replace CAT5 cables running from the HUB to that device.

OutBack Power Systems

Two Year Limited Warranty

OutBack Power Systems Inc. warrants that the products it manufacturers will be free from defects in materials and workmanship for a period of two (2) years subject to the conditions set forth below.

The limited warranty is extended to the original user and is transferable. The limited warranty term begins on the date of invoice to the original user of the product. The limited warranty does not apply to any product or part thereof damaged by a) alteration or disassembly, b) accident or abuse, c) corrosion, d) lightning, e) reverse polarity, f) repair or service provided by an unauthorized repair facility, g) operation or installation contrary to instructions pertaining to the product.

OutBack Power Systems' liability for any defective product or any part thereof shall be limited to the repair or replacement of the product, at OutBack Power Systems' discretion. OutBack Power Systems does not warrant or guarantee the workmanship performed by any person or firm installing its products.

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REGISTER YOUR PRODUCTS!

Your purchase of an OutBack Power Systems product is an important investment. Registering your products will help us maintain the standard of excellence you expect from us in terms of performance, quality and reliability.

Please take a moment to register and provide us with some important information.

Name: ____
Address: ____
City, State, Zip Code: ___________________________________
Country: ____
Telephone Number: ______________________________________
E-mail: ____

Sold by: ____
Installer: ____
Purchase Date: ____

Model Number:____
Serial Number: ____

Circle all that apply:

Off-Grid Installation
Utility Connected Installation
Residential Installation
Commercial Installation
North America Location
Other ______________________

EXTENDED WARRANTY APPLICATION

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PRODUCT	REQUIRED SURGE PROTECTION	EXTENDED WARRANTY COST
FX2024	AC Input; AC Output, DC Input	$300.00
FX2048	AC Input; AC Output, DC Input	$300.00
MX60	DC Input; DC Output	$100.00
MATE	NA	$50.00
HUB 4	NA	$35.00
HUB 10	NA	$50.00

Product Covered	**Serial Number**	**Quantity**	**Extended Warranty Cost**

Total ____________________

Send check or money order payable to OutBack Power Systems. Include a completed copy of this application and send to:

OutBack Power Systems
Extended Warranty Program
19009 62nd Ave NE
Arlington WA 98223 USA

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OutBack Power Systems

HUB-4 and HUB-10
System Communication Manager

Installation and User Guide

10
9
8
7
6
5
4
3
2
1
MATE

Please check our website at www.outbackpower.com for the latest product information

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19009 62nd Ave NE, Arlington WA 98223 USA
Tel 360 435 6030
Fax 360 435 6019

INTRODUCTION

The OutBack Power Systems HUB-4 and HUB–10 System Communications Manager allows the interconnection of up to ten OutBack power conversion devices with the OutBack MATE. The interconnection creates a completely integrated Power System that is coordinated and managed by the MATE.

The OutBack HUB communicates stacking phase, load share, incremental start-up and shut down information directly between the inverters. Interconnection cabling is standard CAT5 eight wire with RJ45 modular jacks. The HUB is powered via any FX inverter/charger or MX60.

The OutBack HUB-4 allows the MATE to control any combination of four FX series inverters/chargers and MX60 charge controllers. The OutBack HUB-10 allows the MATE to control up to eight FX series inverters/chargers or up to 10 devices of any combination.

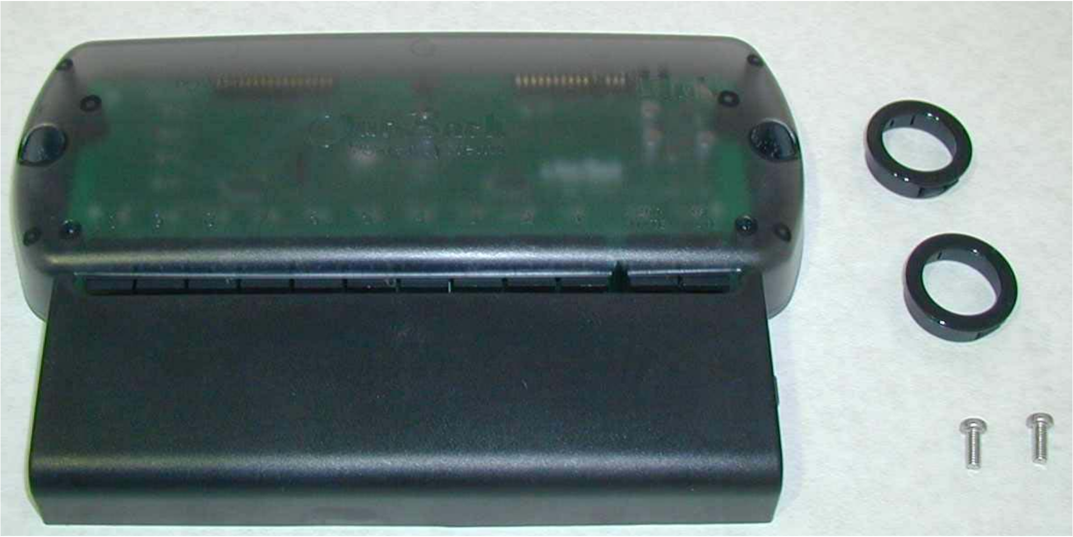
Kit contents:

HUB System Communications Manager

Wiring Cover

(2) #10 x ½” Philips head mounting screws

(2) Snap-in 1” conduit bushings

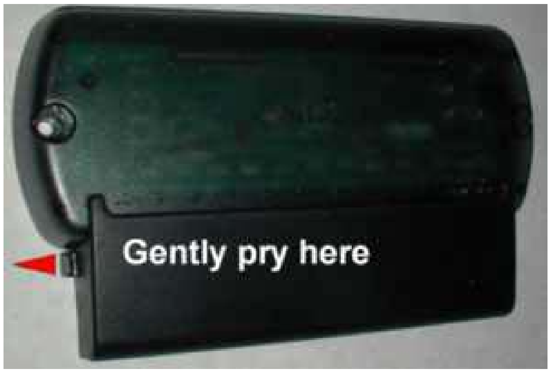


INSTALLATION

The OutBack HUB is designed for surface mounting in an Indoor location.

The cabling from the HUB to the FX inverters/chargers, MX60 PV MPPT charge controller and MATE uses standard CAT5 type computer cable. Consult your local inspector for specific installation requirements. The current and voltage in the communication cable is limited to less than 30 volts DC and considered to be a “limited energy circuit”. No conduit should be required.

The HUB utilizes a snap on wiring cover to protect cabling, eliminate accidental unplugging of cables, and to provide a clean looking installation. This solid black cover unsnaps with a screw driver gently prying in the provided slots.



Three phase stacking only

The OutBack HUB is shipped from the factory setup for series (120/240 VAC split phase) and/or parallel (120 VAC or 230 VAC single phase) stacking. If three phase stacking is desired, the cover must be removed and a jumper position changed. The procedure for this is as follows:

1. **Remove the black snap on wiring cover and all cables plugged into the HUB. Label the cable if you think you might confuse them.**
2. **Remove the four philips head screws from the bottom of the HUB. See Figure 1.**
3. **Remove bottom cover and remove the four philips head screws holding the green PCB to the upper cover. See Figure 2.**
4. **Move the plug-in jumper from the series/parallel location to the three phase location. See Figures 3 & 4.**
5. **Replace PCB and bottom cover.**

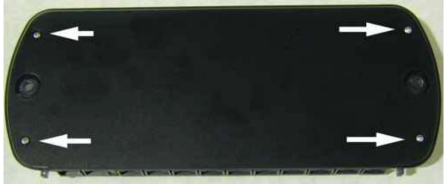


Figure 1

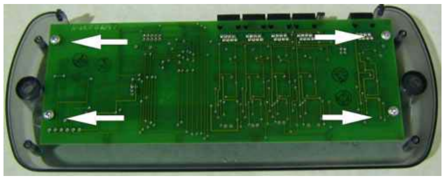


Figure 2

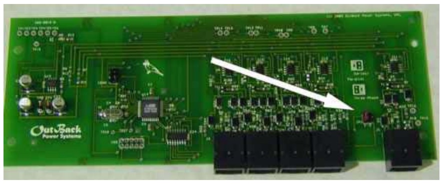


Figure 3

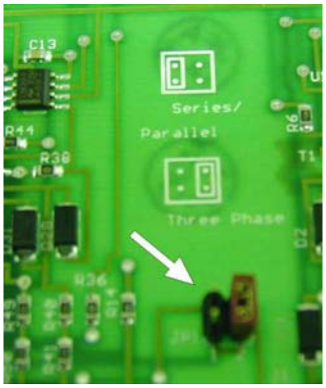


Figure 4

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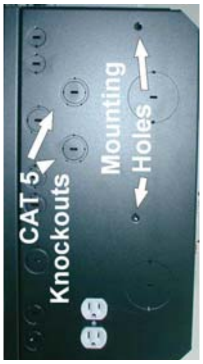
MOUNTING

The OutBack HUB can be wall mounted in any orientation, also the OutBack PS2AC has mounting holes for the HUB incorporated in to it.

Typical Wall Mount

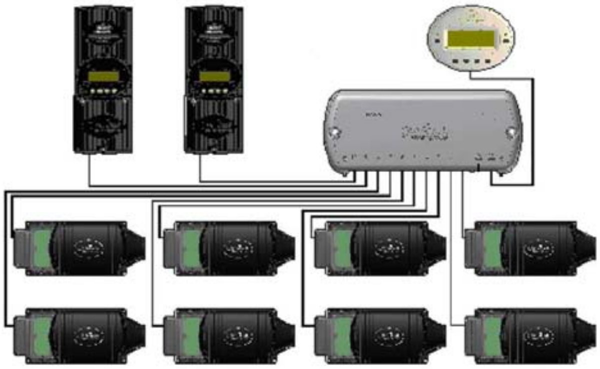
PS2AC Mounting



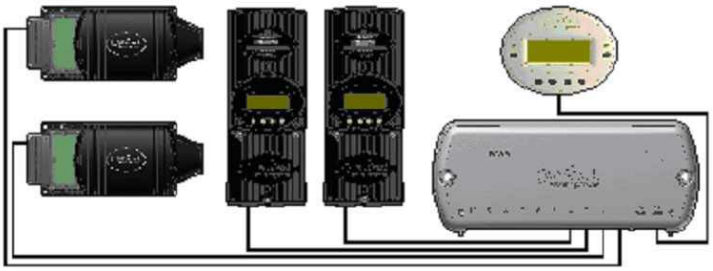
When mounting to an OutBack PS2AC, use the supplied #10 sheet metal screws to attach the HUB to the side of the PS2AC. Remove one or more of the two 1" knockouts, and insert the snap in conduit bushings supplied with the HUB.

COMMUNICATION NETWORK CONFIGURATION

TYPICAL HUB-10 CONFIGURATION



TYPICAL HUB-4 CONFIGURATION



WIRING ORDER

Once mounted, cables can be connected to the HUB. The OutBack HUB has 4 to 10 RJ45 jacks (hence called Ports) that allow multiple OutBack products to be attached. These ports are numbered 1 to 10. The port labeled 1st MATE is for the OutBack MATE to be plugged into. Due to the large number of possible HUB wiring combinations, it is suggested that OutBack devices to be connected be installed using one of the following methods. Connections can be made with the FX inverter/charger or MX60 MPPT charge controller powered up. For the FXs output breakers should be open until stacking programming is complete. The OutBack MATE should always be plugged in last.

NOTE: To allow operation of the HUB, at least one OutBack power conversion device must be plugged into Port 1.

Single FX or MX

If only a single OutBack FX inverter/charger or a single MX60 MPPT charge controller is to be used, it should be plugged into Port 1 of the HUB. Additional OutBack inverters, controllers or other future OutBack devices such as the OutBack Smart Shunt can be plugged into any port.

Multiple FXs non-stacked

Multiple FX inverters/chargers can be plugged into any port as long as at least one FX is plugged into Port 1. Other OutBack devices can be plugged into any of the unused ports.

Multiple MX60 controllers

Multiple MX60 MPPT charge controllers can be plugged into any port as long as at least one is plugged into Port 1. Other OutBack devices can be plugged into any unused ports.

Single/parallel phase stacked

When connecting a "series-parallel stacked" inverter/charger system to a HUB, the FX inverter/charger that is to be the master ***must*** be plugged into Port 1. For clarity, any additional FXs should occupy the adjacent Ports. Other OutBack devices can be plugged into any of the unused ports.

Some PC monitoring software requires that 120/240 VAC series stacked or series-parallel stacked FX inverter/charger systems be wired with all LEG 1 (L1) phased FXs as odd numbered Ports and all LEG 2 (L2) phased FXs as even numbered Ports. This arrangement also makes programming of the power save level settings of the slave FXs more intuitive.

Three phase FX stacking

When connecting a three phase stacked system the FX inverter/charger that is to be the master (Phase A) ***must*** be plugged into Port 1. The phase B slave ***must*** be connected to Port 2, and the phase C slave ***must*** be connected to Port 3. The HUB jumper must be in the three phase position as described in the *Three phase stacking* section. Other OutBack devices can be plugged into any unused ports. Currently, only three inverters can be configured in a three phase arrangement – but additional non-stacked inverters can be plugged into any of the unused ports of the HUB.

Connecting the MATE

THE OUTBACK MATE SHOULD BE CONNECTED LAST. It also must be connected to the jack labeled "1st MATE". If any of the OutBack devices plugged into the HUB are powered, the MATE will power up as soon as it is connected. Upon powering up, the MATE will display a greeting and the software revision information. Immediately following this revision screen the MATE will display "Searching for Devices - HUB Found". If the MATE does not find the HUB, check all wiring, make sure power is applied to all connected devices and try again. (See Troubleshooting Section)

After the device found screen, the MATE will display a Port Assignment screen. Verify the device wiring with the Port Assignment screen.

Pretty lights

When the first OutBack product that is powered plugs into the HUB, the HUB will go through a power up sequence that flashes all of its LEDs. The POWER LED will remain on any time that one or more OutBack products that are powered are plugged in. After the MATE is plugged in, it will start communicating with all of the connected devices. Each Port has an LED associated with it that is visible through the cover. Any device that is plugged in should have a flickering LED when the MATE is communicating with it.

Wiring Cover Knockouts

The OutBack HUB has a wiring cover that has knockouts relieved into the plastic. Using a sharp knife, simply cut out the desired knockout for the MATE cable to pass through.

Reinstall the wiring cover by snapping it over the posts on the side of the HUB.

CONGRADULATIONS! Your OutBack Power Systems HUB is now installed.

HUB OPERATION

The OutBack HUB is designed to interconnect multiply OutBack Power Systems products to an OutBack MATE. This section will describe the operation of the MATE as it applies to the HUB, please see the MATE User Manual for more information.

In order to operate correctly, the HUB requires that the MATE be code version **2.0** or higher. (See 'Checking the MATE Version' in the Troubleshooting section)

Using the OutBack MATE with a HUB

When the MATE is plugged into the HUB, immediately after the MATE displays the greeting screens, 'Searching For Devices' should be displayed, along with 'Hub Found'.

```
      Searching
     For Devices
      HUB Found
```

Next the Port Assignment screen will be displayed, along with the ID of any connected OutBack Devices. In the example to the right, two FXs and two MXs are connected to the HUB.

```
Port Assignment
1> FX  2> FX  3> MX 4> MX
5>     6>     7>     8>
9>     10>    SM>
```

While navigating the various screens and menus in the MATE, the information displayed often only applies to a single device on a single Port. In these cases the Port number is displayed in the upper left hand corner of the MATE screen. To navigate through the Ports, use the 'PORT' button, usually the left most lower button.

```
STATUS/FX/METER - P01
Output              120 vac
Voltage
DOWN    UP   TOP    PORT
```

Refer to the Troubleshooting section if any problems are encountered.

Adding a Device to an operating HUB

Any time an OutBack device is removed or added to a HUB, or its' Port is changed, the MATE must re-poll the system to find the locations of all the new or moved devices. This is accomplished by either unplugging and re-plugging the MATE from the HUB, or by the following procedure:

☐ Make sure the MATE display is on its' Main screen. Press and hold both lower left buttons simultaneously to return to the Main page from anywhere in the menus.

```
MAIN----------------------------
            12:00:00P

SUM STATUS SETUP ADV
```

☐ Press the SETUP button then MATE to go to the SETUP/MATE screen

```
SETUP/MATE/PAGE1--------
Choose category:

CLOCK  CNT   GLOW  PG2
```

☐ Press PG2 and then COMM to go to the SETUP/MATE/COMM screen.

```
SETUP/MATE/PAGE2--------
Choose category:

PG1 SUMRY  COMM  MAIN
```

☐ Press REPOLL to have the MATE find any new or moved OutBack products.

```
SETUP/MATE/COMM--------
Choose category:

BACK REPOLL PC DEBUG
```

TROUBLESHOOTING

<table>
<tr><td>Hub power LED does not light</td><td>The HUB is powered from other OutBack power conversion devices (FX or MX). Make sure that the DC breakers for all OutBack products connected to the HUB are on. Check or replace CAT5 cables running from the HUB to the OutBack products.</td></tr>
<tr><td>MATE does not find the hub</td><td>Check the revision screen on power up of the MATE. Code version must be 2.0 or higher. Check or replace CAT5 cables running from the HUB to the OutBack products, as well as the cable from the MATE to the HUB.</td></tr>
<tr><td>MATE does not see all connected devices</td><td>Verify that all connected devices have DC power applied and are functioning properly. Check or replace CAT5 cables running from the HUB to the OutBack products. If any OutBack products were added or moved on the HUB follow the instructions in ‘Adding a Device to an Operating HUB’ section.</td></tr>
<tr><td>MATE displays a ‘COMM ERROR’</td><td>If the MATE receives too many interrupted or corrupt communications with OutBack products attached to the HUB, it will display a ‘COMM ERROR’ screen. Choosing ‘VIEW DEBUG’ takes you to a screen that lists all ports and accumulated errors. Any Port experiencing errors can be found by the error count after the Port number. In the example to the right, Port 4 has a large number of errors detected (04:025 means Port 4: showing 25 errors). Pressing any key will take you to the SETUP/MATE/COMM screen, which will allow the error counts to be reset using the ‘RSET’ button, the Debug screen can be redisplayed by using the ‘VIEW’ button, or user can get back to the SETUP menu by using the ‘BACK’ button. Use the information on the Debug screen to locate the problem device. Make sure that its’ DC breaker in on, and that is operating correctly. Check or replace CAT5 cables running from the HUB to that device.
<pre>
00:000   01:000   02:000
03:000   04:025   05:001
06:001   07:001   08:001
09:001   10:001   2M:001
</pre></td></tr>
</table>

MATE / HUB CABLES

OBC-3	Three foot cable with green jacket
OBC-6	Six foot cable with green jacket
OBC-50	Fifty foot cable with green jacket

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Please take a moment to register and provide us with some important information.

Name: ______________________________

Address: ______________________________

City, State, Zip Code: ______________________________

Country: ______________________________

Telephone Number: ______________________________

E-mail: ______________________________

Sold by: ______________________________

Installer: ______________________________

Purchase Date: ______________________________

Model Number: ______________________________

Serial Number: ______________________________

Circle all that apply:

Off-Grid Installation   Grid-Tie Installation

Residential Installation   Commercial Installation

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FX2048	AC Input; AC Output, DC Input	$300.00
MX60	DC Input; DC Output	$100.00
MATE	NA	$50.00
HUB 4	NA	$35.00
HUB 10	NA	$50.00

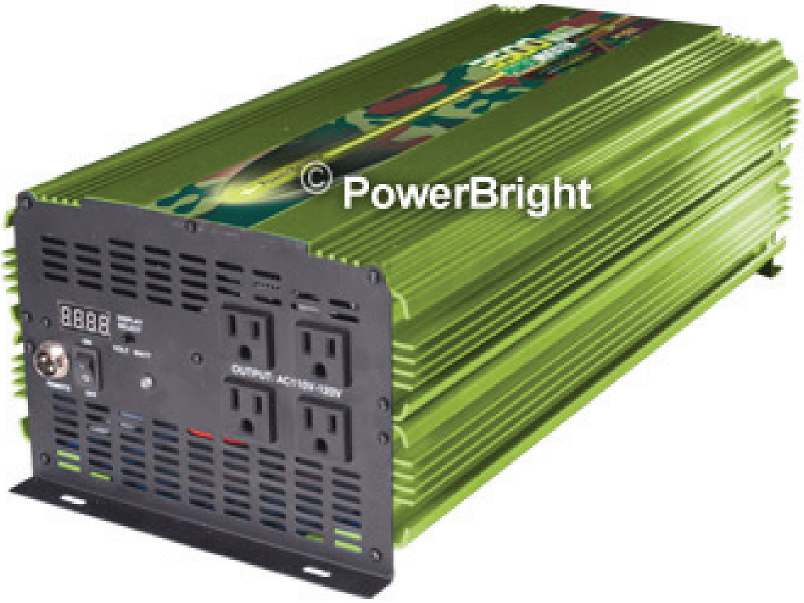
Product Covered	**Serial Number**	**Quantity**	**Extended Warranty Cost**
		Total	

Send check or money order payable to OutBack Power Systems. Include a completed copy of this application and send to:

OutBack Power Systems
Extended Warranty Program
19009 62nd Ave NE
Arlington WA 98223 USA

YOUR Leader in POWER Solutions ++

PowerBright



The ML3500 24 Volt DC to AC Power Inverter provides 3500 watts of continuous power, with a peak surge of 7000 watts.

This unit has the following features:

- Anodized aluminum case which provides durability & maximum heat dissipation.
- Built-in Cooling Fan
- Digital Led Display (Input DC Voltage or Output Wattage)
- Overload Indicator
- Power ON/OFF Switch

Specifications	
Continued Power	3500W
Peak Load Power Rate	< 7000W
Overload Output Power	3550-3800W
No Load Current Draw	< 0.35A
Input DC Voltage Range	20-30V
Output Voltage Range	117 +/- 10%
Output Frequency Range	60 +/- 3Hz
Max Outer Temperature	< 65 C
Max Power Efficiency	> 90%
High Voltage Cut Off Level	30.5 +/- 1V
Low Voltage Alarm Level	21 +/- 0.5V
Low Voltage Cut Off Level	20.5 +/- 0.5V
Short Protect	Yes
Overload Protect	Yes
Dimension (LxWxH) in	19.92 x 8.9 x 6.1
Weight	21 lbs
Standard Test Voltage Input	DC 24V

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PowerBright™

ML3500-24
POWER INVERTER
ONDULEUR DE COURANT

110 VOLT

PLEASE READ THIS MANUAL CAREFULLY BEFORE OPERATION. S.V.P., LIRE CE MANUEL AVEC SOIN AVANT UTILISATION

Welcome

Please read this manual thoroughly before operating your new PowerBright product, as it contains the information you need to become familiar with its features and obtain the performance needed for your operation. Please keep this manual on file for future reference.

About PowerBright Inverters

PowerBright, an innovator in portable inverter design, has developed a new line of super-efficient power inverters with the highest surge capability in the industry. These extremely advanced, microprocessor controlled units run cooler and more reliable than any in their class. Their superior surge capability allows them to start even the most difficult loads, including color televisions, TV/VCR combinations, microwaves, refrigeration units, and even small air conditioners! They also boast the highest efficiency available (up to 90%), which translates into longer running time and extended battery life.

PowerBright Inverters convert low voltage, direct current (DC) to 110 volt alternating current (AC). Depending on the model and its rated capacity, the inverters draw power either from standard 24 volt automobile and marine batteries or from portable high power 24 volt sources.

GETTING STARTED

When you turn on an appliance or a tool that operates using a motor or tubes, it requires an initial surge of power to start up. This surge of power is referred to as the “starting load” or “peak load.” You will need to determine how much power your tool or appliance requires to start up (starting load) and it’s continued running power requirements (continuous load).

Power consumption is rated either in wattage (watts), or in amperes (amps), and this information is usually stamped or printed on most appliances and equipment. If this information is not indicated on the appliance or equipment, check the owner’s manual or contact the manufacturer to determine if the device you are using is compatible with a modified sine wave source.

Multiply: AMPS X 110 (AC voltage) = WATTS

This formula yields a close approximation of the continuous load of your appliance.

Multiply: WATTS X 2 = Starting Load

This formula yields a close approximation of the starting load of your appliance.

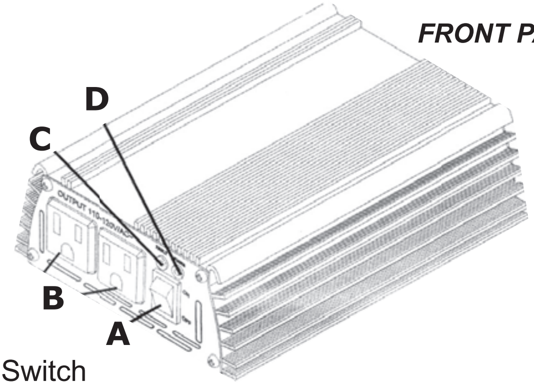
Most often the start up load of the appliance or power tool determines whether your inverter has the capability to power it. To determine whether the inverter will operate a particular piece of equipment or appliance, run a test. The inverters are designed to automatically shut down in the event of a power overload. This protection feature prevents damage to the unit while testing appliances and equipment with ratings in the 3500 watt range.

If an appliance in the 3500 watt range will not operate properly when first connected to the inverter, turn the inverter rocker switch ON (I), OFF(O), and ON(I) again in quick succession. If this procedure is not successful, it is likely that the inverter does not have the required capacity to operate the appliance in question.

IMPORTANT

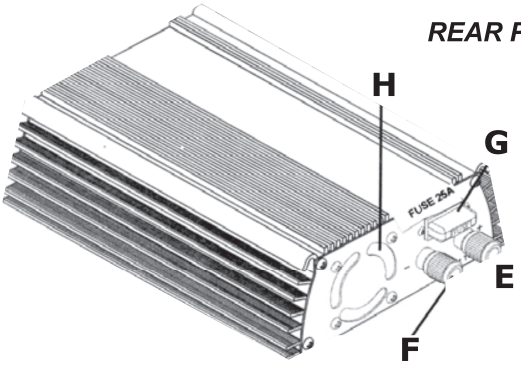
- • The inverter is designed to operate from a 24 volt power source only. Do not attempt to connect the inverter to any other power source, including any AC power source.
- • Do not attempt to extend or otherwise modify the 24 volt power cord attached to your inverter.
- • 110 volts of current can be lethal. Improper use of your inverter may result in property damage, personal injury or loss of life.

FRONT PANEL



A. ON/OFF Rocker Switch
B. Dual Standard North American 120V AC Outlets
C. Red LED = Overload
D. Green LED = Power ON

REAR PANEL

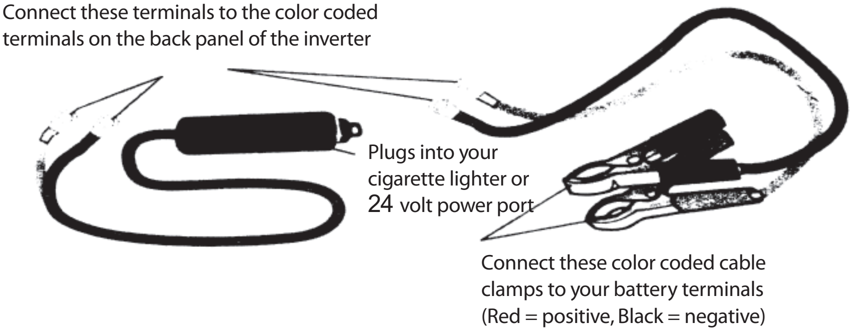


E. Power Input Terminal Red = Positive
F. Power Input Terminal Black = Negative
G. Cooling Fan
H. Fuse Cover

CONNECTING YOUR INVERTER

Through the Car Cigarette Lighter or 24 Volt Power Port

1. Make sure the On/OFF rocker switch located on the front panel of the inverter is in the OFF (0) position.
2. Connect the 24 volt power cord the power input terminals at the rear of the inverter making sure to match the color coded cables to the color coded terminals on the inverter (RED = Positive, BLACK = Negative). Do not over tighten these screws.
3. Remove your cigarette lighter and push the 24 volt power plug firmly into the cigarette lighter receptacle in your vehicle.
4. Turn the inverter rocker switch to the ON (I) position. The LED Indicator Light should glow GREEN confirming that there is power running to the inverter.
5. Turn the inverter rocker switch to the OFF (0) position. (The GREEN LED Power Indicator light may “blink” briefly and/ or the internal audible alarm may make a momentary “chirp.” This is normal).
6. Check that the appliance to be operated is turned OFF. Plug the appliance into one of the two AC receptacles on the front panel of the inverter.
7. Turn the inverter rocker switch the ON (I) position. Turn the equipment or appliance on.


Connect these terminals to the color coded terminals on the back panel of the inverter
Plugs into your cigarette lighter or 24 volt power port
Connect these color coded cable clamps to your battery terminals (Red = positive, Black = negative)

Directly to the 24 Volt Power Source

1. Make sure the ON/OFF rocker switch located on the front panel of the inverter is in the OFF (0) Position.
2. Connect the cables to the power input terminals at the rear of the inverter making sure to match the color coded cables to the color coded terminals, and tighten the screws to make a secure connection. Do not over tighten these screws.
3. Connect the cable from the Negative (-) terminal (BLACK) on the inverter to the Negative terminal on the 24 volt power source. Double check that the connection is secure.
4. Check that the cable you have just installed is properly connected. Make certain that the cable is connected to the negative terminals on both the inverter and the 24 volt power source.
5. Connect the cable from the Positive (+) terminal (RED) on the inverter to the Positive terminal on the power source. Double check that the connection is secure.
6. Follow directions 4-7 in the above section titled “Through the Car Cigarette Lighter or 24 Volt Power Port”.

NOTE:

- The audible alarm many make a momentary “chirp when the inverter is turned OFF (O). This same alarm many also sound when the inverter is being connected to or disconnected from the 24 volt power source.
- Use of an extension cord from the inverter the appliance or equipment being operated will not significantly decrease the power being generated by the inverter. For best operating results, the extension cord should be no more than 50 feet long.
- If the green Led blinks when you first turn the inverter ON, this indicates that there is a short circuit within the power supply. Turn the inverter OFF. Remove the 24 volt plug from the cigarette lighter socket, firmly reinsert the plug, and then turn the inverter ON again. Or if you are using the cables connected to a 24 volt power source, try removing and reconnecting the clamps. If this does not remedy the problem try using a different 24 volt power source.

BLOWN AUTOMOTIVE FUSES

Depending on the make and model of your automobile, running the power inverter near full capacity from your cigarette light port many result in a blown automotive cigarette lighter fuse. This fuse will need to be replaced with the same size fuse. Please note that a blown automotive fuse will not cause damage to your car wiring.

To avoid blowing an automotive fuse in this situation, do not operate the power inverter at peak over 150 watt wattage for extended periods of time from your cigarette lighter of 24 volt power port.

BLOWN POWER INVERTER FUSES

Your power inverter is equipped with a 40 amp spade type fuse. With reasonable care it should not be necessary to replace this fuse. Most blown fuses are the result of reverse polarity or a short circuit within the appliance or equipment being operated. If the fuse happens to blow, disconnect the appliance or equipment immediately, find the source of the problem, repair it, and then install a new fuse.

TELEVISION AND AUDIO SUGGESTIONS

Although these inverters are shielded and filtered to minimize signal interference, some interference with your television picture may be unavoidable, especially with weak signals. However, here are some suggestions that may improver reception.

1. First, make sure that the television antenna produces a clear signal under normal operating conditions (i.e., at home plugged into a standard 110 AC wall outlet). Also, ensure that the antenna cable is properly shielded and of good quality.
2. Change the positions of the inverter, antenna cables and television power cord.
3. Isolate the television, its power cord and antenna cables from the 24 volt power source by running an extension cord from the inverter to the television set.
4. Coil the television power cord and the input cables running from the 24 volt power source to the inverter.
5. Attach a “Ferrite Data Line Filter” to the television power cord. More than one filter many be required. These filters are available at most electronic supply stores.

NOTE:

- Inexpensive sound systems many emit a “buzzing” sound when operated with the inverter. This is due to inadequate filters in the sound system. There is no solution to this problem short of purchasing a sound system with a higher quality power supply.

SOURCE OF POWER

Most automobile and marine batteries will provide an ample power supply to the inverter for 30 to 60 minutes even when the engine is off. Actual time may vary depending upon the age and condition of the battery, and the power demand being placed on it by the equipment being operated with the inverter.

If you decide to use the inverter while the engine is off, we recommend that you start the engine every hour and let it run for approximately 10 minutes to recharge the battery. We also recommend that the device plugged into the inverter be turned OFF before starting the vehicle engine.

Although it is not necessary to disconnect the inverter when turning over the engine, it may momentarily cease to operate as the battery voltage decreases. When the inverter is not supplying power, it draws very low amperage from the battery and may be left connected to the battery for up to three hours. However, we recommend the inverter always be disconnected when not in use.

INVERTER PROTECTION FEATURES.

The RED LED Indicator light will turn on and the inverter will turn itself off automatically when:

1. The power input from the battery drops to 9.5 volts. (When the power input drops to 10.5 volts, an alarm will sound for an extended period).
2. The power input from the battery exceeds 15.5 volts.
3. The continuous draw of the equipment or appliance being operated exceeds 3500 watts.
4. The surge draw of the equipment or appliance being operated exceeds 7000 watts.
5. The circuit temperature exceeds 165 °F.

NOTE:

- The inverter is equipped with a thermal fan which is designed to run if the inverter should need to be cooled while the inverter is operation. Automatic shut down caused by high circuit temperatures will occur when the cooling fan is unable to maintain a cool enough temperature for safe operation of the inverter.
- In the event of automatic shut down or continuous audible alarm, turn the inverter rocker switch to the OFF (0) position until the source of the problem has been determined and resolved.

SAFETY PRECAUTIONS

For best results place the power inverter on a reasonably flat surface.

- Keep the inverter dry. Do not expose it to rain or moisture. DO NOT operate the inverter if you, the inverter, the device being operated or any other surfaces that may come in contact with any power source are wet. Water and many other liquids can conduct electricity which may lead to serious injury or death. Avoid placing the inverter on or near heating vents, radiators or other sources or heat. Do not leave the inverter in the passenger compartment of your vehicle.
- Store in a cool dry place.
- Do not place the inverter in direct sunlight.
- Ideal air temperature should between 50°and 80° F •
- In order to properly disperse heat generated while the inverter is in operation, keep it well ventilated. While in use, maintain several inches of clearance around the top and sides of the inverter.
- Do not use the inverter near flammable materials. Do not place the inverter in areas such as battery compartments where fumes or gases many accumulate.

HOW POWER INVERTERS WORK

There are two stages in which a power inverter changes the 24 volt DC (or battery) power into 110v AC (household current).

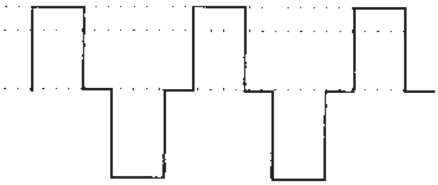
STAGE 1:

The inverter uses a DC to DC converter to increase the DC input voltage from the power source to 145 volts DC.

STAGE 2:

The inverter then converts the high voltage DC into 110v AC (household current), using advanced MOSEFT transistors in a full bridge configuration.

This design provides all our inverters with the capability to start and run difficult reactive loads, while providing excellent overload capability. The waveform that is generated by this conversion is a “modified sine wave” as shown in the diagram below.



MODIFIED SINE WAVE

The modified sine wave produced by our inverters has a root mean square (RMS) voltage of 110 volts. The majority of AC voltmeters are calibrated for RMS voltage and assume that the measured waveform will be a pure sine wave.

Consequently, these meters will not read the RMS modified sine wave voltage correctly and, when measuring the inverter output, the meters will read about 20 to 30 volts too low. To accurately measure of the output voltage of the inverter, use a true RMS reading voltmeter such as a Fluke 87, Fluke 8060A, Beckman 4410, Triplet! 4200 or any multimeter identified as “True RMS.”

IN REVIEW

- Never attempt to operate the inverter from any power source other than a 24 volt DC battery.
- The inverter is designed to be connected to the power source with the 24 volt power plug. Do not attempt to modify the power cord or plug.
- While connecting the inverter to the power source, make certain the inverter is positioned far away from any potential source of flammable fumes or gases.
- Make certain the power consumption of the appliance or equipment you whish to operate is compatible with the capacity of the inverter. Do not exceed 3500 watts.
- When attempting to operate battery chargers, monitor the temperature of the battery charger for approximately 10 minutes. If the battery charger becomes abnormally warm, disconnect it from the inverter immediately.
- Use only 40 amp spade type fuses.
- When operating the inverter with an automobile or marine battery, start the engine every 30 to 60 minutes and let it urn for approximately 10 minutes to recharge the battery.
- In the event of a continuous audible alarm or automatic shut off, turn the inverter OFF immediately. Do not restart the inverter until the source of the problem has been identified and corrected.
- To avoid battery drain, always disconnect the inverter when not in use.
- Do not expose the inverter to rain or moisture.
- Avoid placing the inverter near sources of heat or in direct sunlight.
- While in use, make sure the inverter is properly ventilated.
- Do not operate the inverter near flammable materials, fumes or gases.

TROUBLESHOOTING

PROBLEM: Low or No Output Voltage

Reason	Solution
Poor contact with the battery terminals	Clean terminals thoroughly
Using incorrect type of voltmeter to test output voltage	Use true RMS reading meter

PROBLEM: Overload LED Stays ON

Reason	Solution
Battery voltage below 11V	Recharge or replace battery
Equipment being operated draws too much power	Use a higher capacity inverter or do not use this equipment
Inverter is too hot (thermal shutdown mode)	• Allow inverter to cool •Check for adequate ventilation •Reduce the load on the inverter to rated continuous power output
Unit may be defective	See warranty and call customer service

TROUBLESHOOTING

PROBLEM: TV Interference

Reason	Solution
Electrical interference from the inverter	Add a ferrite data line filter onto the TV power cord

PROBLEM: Low Battery Alarm On All The Time

Reason	Solution
Input voltage below 11V	Keep input voltage above 11V to maintain regulation
Poor or weak battery condition	Recharge or replace battery
Inadequate power being delivered to the to the inverter or excessive voltage drop	•Use lower gauge wire • Keep wire length as short as possible

PROBLEM: TV Does Not Work

Reason	Solution
TV does not turn on	•Try turning the inverter ON/ OFF/ ON •Contact TV manufacturer for start up surge and/or if the TV is compatible with a modified sine wave

SPECIFICATIONS:

Max. Continuous Power	3500W
Surge Capability (Peak Power)	7000W
No Load Current Draw Rating	<0.18A
Waveform	Modified Sine Wave
Input Voltage Range	20 - 30 VDC
AC Receptacles	110V AC 3 prong grounded
Fuse	40 amp (spade type)

POWER CORD SPECIFICATION

Gauge	Type	Amount
AWG#12	Parallel wire 2P (Black/Red) With Battery Clamp	1pcs
AWG#12	2C (Black) With Cigarette Plug	1pcs

SERVICE WARRANTY

- Your PowerBright™ equipment is guaranteed against any manufacturing defects for one full year from date of purchase.
- This warranty card is issued only at the time of original purchase; it is non-transferable.
- Damage caused by accident, misuse, do-it-yourself repairs, sand or water is not covered by this warranty, witch is only valid at a PowerBright™ facility.
- All mail or transportation costs including insurance are at the expense of the owner. All other claims of any nature are not covered.
- This warranty card is valid only in USA and Canada.

INTRODUCTION

Cet onduleur PowerBright™ a été conçu pour vous offrir des années d'utilisation sûre et fiable. Veuillez lire attentivement cette notice avant d'utiliser votre appareil afin de vous familiariser avec ses caractéristiques et en optimiser les capacités. Conservez cette notice pour pouvoir y référer au besoin.

À PROPOS DES ONDULEURS PowerBright™

Révolutionnant le domaine des onduleurs portatifs, PowerBright™ a créé une toute nouvelle ligne d'onduleurs à haute performance. Le courant transitoire de crête développé par ses onduleurs gérés par microprocesseur excède les capacités de la majorité des produits de même type offerts dans l'industrie, tout en offrant une stabilité et une fiabilité accrues. Leur puissance supérieure permet d'alimenter des appareils domestiques tels que téléviseur, magnétoscope, four à micro-ondes, réfrigérateur et même de petites unités de climatisation! En atteignant la plus haute efficacité disponible (jusqu'à 90 %), ils maximisent la période d'utilisation et la durée de vie de la batterie.

Ces onduleurs transforment le courant continu d'une batterie en courant alternatif de 110V. Selon le modèle et la consommation de courant requise, les onduleurs peuvent être branchés à la prise 24 V de votre voiture, camionnette, bateau ou véhicule récréatif ou directement à une batterie 24 V.

UTILISATION DES ONDULEURS

Lorsque vous mettez en marche un appareil ou un outil fonctionnant avec un moteur ou des tubes, une charge initiale est requise pour effectuer le démarrage. Cette charge de courant est communément appelée « puissance de surtension » ou « puissance maximum ». Il est important de déterminer la consommation de courant requise par les appareils que vous souhaitez alimenter au démarrage et la charge nominale requise de façon continue.

La consommation de courant requise par un appareil est généralement indiquée en watts ou en ampères sur la plupart des appareils. Si cette information n’est pas indiquée, vérifiez la notice d’utilisation ou contactez le manufacturier pour vous assurer que votre appareil est compatible avec une onde sinusoïdale modifiée.

Pour calculer la consommation de courant d’un appareil en watts,
utilisez l’équation suivante : Intensité de courant en ampères X 110
(tension CA) = WATTS

Cette formule fournit la charge nominale continue approximative requise par l’appareil.

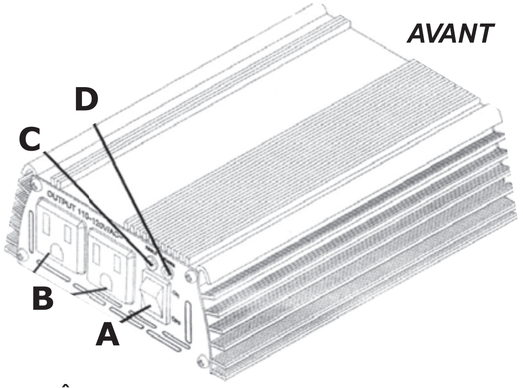
Pour déterminer la puissance de surtension approximative requise par
l’appareil que vous souhaitez alimenter, utilisez la formule suivante:
watts x 2 = puissance de surtension.

En général, le résultat obtenu par cette formule vous indiquera si votre onduleur est assez puissant pour alimenter votre appareil. Pour déterminer si votre onduleur est assez puissant pour alimenter un appareil en particulier, vous pouvez aussi effectuer un test. Les onduleurs sont conçus pour s’éteindre automatiquement en cas de surcharge. Cette protection évite de causer un dommage à l’onduleur en cas de surcharge.

Si un appareil de 3500 watts ne fonctionne pas correctement lorsque branché à un onduleur, allumez, éteignez et rallumez rapidement l’onduleur. Si cette procédure se révèle infructueuse, il y a de fortes chances que votre onduleur ne soit pas assez puissant pour alimenter l’appareil en question.

RENSEIGNEMENTS IMPORTANTS

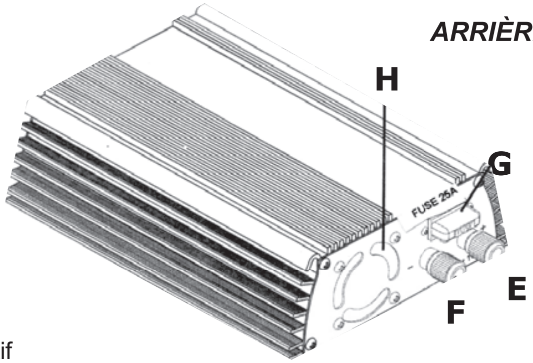
- Cet onduleur ne peut être branché qu’à une source de 24 V. Ne tentez pas de le brancher à une autre source d’alimentation.
- Ne tentez pas de modifier ou d’allonger le cordon d’alimentation de 24 V de votre onduleur.
- Un courant de 110 V peut être mortel. Le mauvais emploi ou le branchement inadéquat de l’onduleur peut endommager l’appareil auquel il est raccordé ou créer des situations dangereuses pour l’utilisateur.



AVANT

A. Interrupteur MARCHE/ARRÊT
B. 2 prises 120V AC standards (Amérique du Nord)
C. LED ROUGE = Surcharge
D. LED VERT = Onduleur allumé

ARRIÈRE

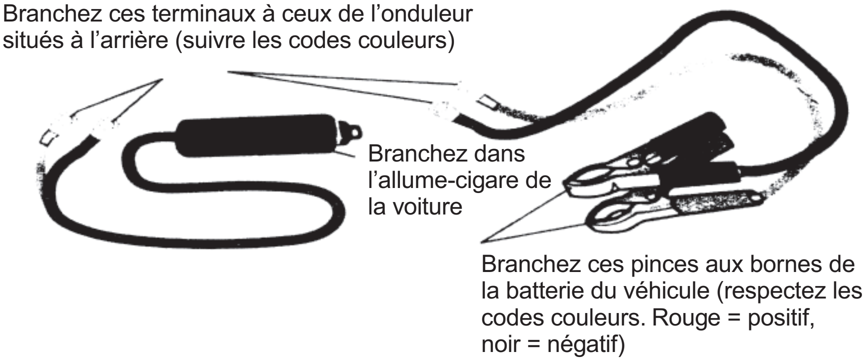


E. Borne rouge = Positif
F. Borne noire = Négatif
G. Ventilateur de refroidissement
H. Couvercle à fusible

BRANCHEMENT DE L’ONDULEUR

Via l’allume-cigarette de votre voiture ou une autre source 24 V

1. Assurez-vous que l’interrupteur situé sur le panneau avant de l’onduleur est à sa position d’arrêt (Off/0).
2. Prenez le cordon d’alimentation de 24 V pour allume-cigarette et branchez les cosses à anneaux dans les deux bornes du panneau arrière de l’onduleur en vous assurant de fixer la pince positive (rouge) à la borne positive de la batterie (rouge) et la pince négative (noire) à la borne négative de la batterie (noire). Serrez fermement l’écrou de chaque cosse, mais sans forcer.
3. Branchez le raccord pour allume-cigarette dans l’allume-cigarette de votre véhicule.
4. Mettez l’interrupteur de l’onduleur en marche (ON/I). Une diode verte devrait s’allumer indiquant que l’onduleur fonctionne et que du courant est disponible.
5. Éteignez l’interrupteur (OFF/0). La diode verte pourrait clignoter brièvement et une alarme pourrait se faire entendre momentanément. Tout est normal.
6. Assurez-vous que l’appareil que vous souhaitez utiliser est éteint. Branchez l’appareil dans l’une des deux prises CA situées sur le panneau avant de l’onduleur.
7. Allumez l’interrupteur de l’onduleur (ON/I). Allumez ensuite votre appareil.


Branchez ces terminaux à ceux de l’onduleur situés à l’arrière (suivre les codes couleurs)
Branchez dans l’allume-cigare de la voiture
Branchez ces pinces aux bornes de la batterie du véhicule (respectez les codes couleurs. Rouge = positif, noir = négatif)

Directement dans une batterie 24 V

1. Assurez-vous que l’interrupteur situé sur le panneau avant de l’onduleur est à sa position d’arrêt (Off/0).
2. Prenez les câbles munis de pinces à batterie et branchez les cosses à anneaux dans les deux bornes du panneau arrière de l’onduleur en vous assurant de fixer la pince positive (rouge) à la borne positive (rouge) de la batterie et la pince négative (noire) à la borne négative (noire) de la batterie. Serrez fermement les écrous sans forcer.
3. Mettez l’interrupteur de l’onduleur en marche (ON/I). Une diode verte devrait s’allumer indiquant que l’onduleur fonctionne et que du courant est disponible.
4. Éteignez l’interrupteur (OFF/0). La diode verte pourrait clignoter brièvement et une alarme pourrait se faire entendre momentanément. Tout est normal.
5. Assurez-vous que l’appareil que vous souhaitez utiliser est éteint. Branchez l’appareil dans l’une des deux prises CA situé sur le panneau avant de l’onduleur.
6. Allumez l’interrupteur de l’onduleur (ON/I). Allumez ensuite votre appareil.

NOTE:

- Une alarme pourrait se faire entendre momentanément lors de la mise en marche de l’onduleur ou lorsque l’onduleur est branché ou débranché de la source 24 V.
- L’utilisation d’une rallonge électrique entre l’appareil et l’onduleur ne diminue pas significativement l’intensité du courant généré par l’onduleur. Pour de meilleurs résultats, la rallonge électrique ne devrait pas dépasser 50 pieds.
- Si la diode verte clignote lors de la mise en marche de l’onduleur, cela signifie qu’il y a un court-circuit au niveau de l’alimentation. Éteignez l’onduleur. Retirez le raccord pour allume-cigarette de l’allume-cigarette, réinsérez-le fermement et rallumez l’onduleur. Si vous utilisez des câbles branchés à une autre source d’alimentation 24 V, retirez et rebranchez les pinces. Si ça ne règle pas le problème, tentez d’utiliser une autre source 24 V.

LE FUSIBLE DE L’ALLUME-CIGARETTE A SAUTÉ

L’utilisation à pleine capacité d’un onduleur branché à un allume-cigarette peut faire sauter le fusible de l’allume-cigarette. Remplacez simplement ce fusible par un fusible de même type et de même force.

Pour éviter qu’une telle chose se produise, n’utilisez par un onduleur branché dans l’allume-cigarette ou dans un autre port 24 V à plus de 150 watts pendant des périodes prolongées. Veuillez noter que cette situation ne causera aucun dommage à votre véhicule.

UN FUSIBLE DE L’ONDULEUR A SAUTÉ

Votre onduleur est équipé d’un fusible de 40 ampères. Une utilisation adéquate devrait éviter le remplacement du fusible. La plupart du temps lorsqu’un fusible saute, cette situation résulte d’une polarité inversée, d’un court-circuit ou de l’utilisation inappropriée d’un appareil. Si un fusible saute, débranchez immédiatement l’appareil alimenté par l’onduleur, cherchez la source du problème, effectuez les modifications nécessaires et remplacez le fusible.

PROBLÈMES AUDIO ET VIDÉO COMMUNS

Même si ces onduleurs sont munis d’un équipement destiné à réduire les risques de parasites qui nuiraient à la réception de certains canaux de télévision, l’interférence est parfois inévitable, spécialement si le signal est faible. Voici quelques suggestions qui pourraient améliorer la réception :

1. Assurez-vous que l’antenne de votre téléviseur produit un signal clair dans des conditions normales d’utilisation (lorsque votre téléviseur est branché dans une prise murale de 110 V à la maison). Assurez-vous également que les câbles d’antenne sont blindés et de bonne qualité.
2. Changez l’orientation de l’onduleur, des câbles d’antenne et du cordon d’alimentation de votre téléviseur.
3. Éloignez votre téléviseur, son cordon d’alimentation et les câbles d’antenne, de la source 24 V, en utilisant une rallonge électrique entre l’onduleur et le téléviseur.
4. Torsadez le cordon d’alimentation de votre téléviseur aux câbles d’entrée se situant entre la source 24 V et l’onduleur.
5. Ajoutez un ou plusieurs filtres antiparasites au cordon d’alimentation de votre téléviseur. Ces filtres sont vendus dans la plupart des centres spécialisés en électronique.

NOTE:

- Certains appareils audio bon marché produisent un bourdonnement lorsqu’ils sont alimentés par un onduleur. Cette situation survient parce que leur bloc d’alimentation ne possède pas les composantes adéquates pour filtrer la sortie sinusoïdale modifiée de l’onduleur. La solution consiste à utiliser un appareil audio muni d’un bloc d’alimentation de meilleure qualité.

SOURCE D’ALIMENTATION

Même si elles peuvent alimenter un onduleur pendant 30 à 60 minutes sans que le moteur tourne, les batteries d’automobiles et de bateaux ne sont pas conçues pour être soumises à des décharges poussées successives. Ainsi, lorsque vous utilisez la batterie comme source d’énergie, nous vous recommandons de démarrer le moteur de votre bateau ou de votre automobile et de le laisser rouler pendant au moins 10 minutes à toutes les heures pour la recharger.

Il est également recommandé d’éteindre l’appareil alimenté par l’onduleur avant de démarrer votre véhicule. L’onduleur fonctionne normalement lorsque le moteur tourne, mais il se peut que la baisse de tension résultant de la demande au démarrage déclenche un arrêt automatique pour tension trop basse.

Lorsqu’il n’alimente pas un appareil, l’onduleur ne consomme que très peu de courant et pourrait demeurer branché pendant près de trois heures, mais il est quand même recommandé de le débrancher lorsqu’il n’est pas utilisé pour éviter de décharger la batterie.

DISPOSITIFS DE PROTECTION DE L’ONDULEUR

Une DIODE ROUGE s’allumera et l’onduleur s’éteindra automatiquement lorsque :

1. La tension baisse à 9,5 V. Lorsque l’onduleur détecte que la tension de la batterie est de 10,5 V, une alarme se fait entendre pendant une période prolongée.
2. La tension excède 15,5 V.
3. L’appareil branché à l’onduleur consomme plus de 3500 watts de façon continue.
4. Le courant transitoire de crête excède 7000 watts.
5. La température interne de l’onduleur dépasse 165 °F.

NOTE:

- • L’onduleur est équipé d’un ventilateur thermique conçu pour refroidir l’onduleur en cours de fonctionnement. L’onduleur s’éteindra automatiquement si le ventilateur ne réussit pas à maintenir la température à un niveau acceptable.
- • En cas d’arrêt automatique ou si une alarme continue se fait entendre, éteignez l’interrupteur de l’onduleur, déterminez et réglez la source du problème.

CONSIGNES DE SÉCURITÉ

Pour une performance optimale, l’onduleur doit être posé sur une surface plane.

- • Gardez l’onduleur au sec. N’exposez jamais l’onduleur à l’eau ou à l’humidité. N’UTILISEZ PAS l’onduleur si vous, l’onduleur ou l’appareil alimenté par l’onduleur êtes en contact avec une surface mouillée. L’eau et plusieurs autres liquides sont conducteur d’électricité et peuvent occasionner des blessures sévères ou la mort.
- • Évitez de placer l’onduleur près des sources de chaleur.
- • Ne laissez pas l’onduleur dans le compartiment à gants de votre véhicule.
- • Entreposez l’onduleur dans un endroit sec et frais.
- • Ne placez pas l’onduleur directement sous les rayons du soleil.
- • La température idéale d’utilisation de l’onduleur varie entre 50°et 80° F.
- • Afin de répartir adéquatement la chaleur générée par l’onduleur lorsqu’il fonctionne, assurez-vous de garder un espace d’air de quelques pouces tout autour.
- • Pendant l’utilisation, gardez l’onduleur éloigné des matières inflammables. Ne placez pas l’onduleur dans des endroits où il pourrait y avoir une accumulation de vapeur ou de gaz explosifs.

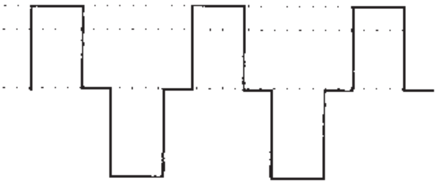
PRINCIPE DE FONCTIONNEMENT DE L'ONDULEUR

L'onduleur PowerBright™ convertit le courant continu d'une batterie 24 V en courant alternatif de 110 V en 2 étapes.

La première étape est accomplie par un convertisseur CC à CC qui élève la basse tension continue de l'entrée en haute tension continue (145 V DC).

La seconde étape est celle de l'onduleur lui-même qui convertit la haute tension en un courant alternatif en sortie (110 V AC).

La conversion CC à CC utilise les techniques modernes de haute fréquence qui éliminent les anciens transformateurs volumineux de la basse fréquence. La seconde étape utilise des semi-conducteurs puissants (transistors MOFSET) qui donnent une excellente capacité de surcharge.



MODIFIED SINE WAVE

Ainsi tous nos onduleurs sont capables de démarrer et de faire fonctionner des appareils qui subissent une forte surtension à la mise en marche. L'onde générée par cette conversion est une onde sinusoïdale modifiée. Cette onde modifiée possède un voltage RMS de 110 V.

La majorité des voltmètres ne sont pas calibrés pour lire la tension RMS et assument qu'il s'agit d'une onde sinusoïdale pure. Incidemment ces voltmètres ne lisent pas les ondes sinusoïdales modifiées correctement et lorsqu'ils mesurent la tension d'une sortie non sinusoïdale, le résultat est de 20 ou 30 V trop bas. Pour mesurer avec précision la tension de sortie, utilisez des voltmètres RMS tels que le Fluke 87, le Fluke 8060A, le Beckman 4410, le Triplet 4200, etc.

EN RÉSUMÉ

- Cet onduleur ne peut être branché qu’à une source de 24 V. Ne tentez pas de le brancher à une autre source d’alimentation.
- Ne tentez pas de modifier ou d’allonger le cordon d’alimentation de votre onduleur.
- Lors du branchement de l’onduleur à une source d’alimentation, assurez-vous que l’onduleur est éloigné de toute source de vapeur ou de gaz inflammables.
- Assurez-vous que la consommation de l’appareil que vous souhaitez alimenter avec l’onduleur est compatible et n’excède pas 3500 watts.
- Lorsque vous tentez d’utiliser un chargeur de batterie, vérifiez la température pendant approximativement 10 minutes. Si le chargeur de batterie est anormalement chaud, débranchez-le immédiatement de l’onduleur.
- Utilisez exclusivement un fusible similaire de 40 ampères.
- Lorsque vous utilisez la batterie comme source d’énergie, nous vous recommandons de démarrer le moteur de votre bateau ou de votre automobile et de le laisser rouler pendant au moins 10 minutes à tous les 30 à 60 minutes pour la recharger.
- Si une alarme se fait entendre de façon continue ou si l’onduleur s’éteint automatiquement, éteignez immédiatement l’onduleur. N’allumez pas l’onduleur tant que le problème n’a pas été identifié et réglé.
- Débranchez l’onduleur lorsque vous ne l’utilisez pas afin d’éviter de décharger la batterie complètement.
- N’exposez jamais l’onduleur à la pluie et à l’humidité.
- Évitez de placer l’onduleur près d’une source de chaleur ou sous la lumière directe du soleil.
- Assurez-vous de garder un espace d’air tout autour de l’onduleur pendant l’utilisation.
- N’utilisez pas l’onduleur en présence de matériaux, de vapeur et de gaz inflammables.

GUIDE DE DÉPANNAGE

PROBLÈME : Il n'y a aucune tension de sortie

Causes possibles	Solutions
Un mauvais contact avec les connexions de la batterie	Nettoyez les connexions à fond
Utilisation d'un mauvais type de voltmètre lors de la mesure de la tension de sortie	Utilisez un voltmètre RMS

PROBLÈME : La diode rouge ne s'éteint plus

Causes possiblesSolutions	
La tension nominale de la batterie est inférieure à 11 V	Rechargez ou remplacez la batterie
L'appareil utilisé demande plus de courant que la puissance de sortie de l'onduleur	Utilisez un onduleur à plus hautes capacités ou cessez d'utilisez cet appareil
La température de l'onduleur est trop élevée	•Laissez refroidir l'onduleur •Vérifiez le ventilateur ou déplacez l'onduleur dans un endroit plus frais •Réduisez la charge imposée à l'onduleur odes prolongées
L'unité est peut-être défectueuse	Vérifiez votre garantie et contactez le

GUIDE DE DÉPANNAGE

PROBLÈME : Des parasites nuisent à la réception de certains canaux

Causes possibles	Solutions
Interférence électrique de l’onduleur	Ajoutez un ou plusieurs filtres antiparasites au cordon d’alimentation de votre téléviseur

PROBLÈME : Une alarme indique que la batterie est trop faible en tout temps

Causes possibles	Solutions
La tension nominale de la batterie est inférieure à 11 V	Maintenez la tension nominale à plus de 11 V
La batterie est trop faible ou en mauvaise condition	Rechargez ou remplacez la batterie
Le courant transmis à l’onduleur est inadéquat ou il y a une chute de tension marquée	•Utilisez des câbles plus courts • Utilisez un fil de jauge plus petit

PROBLÈME : Le téléviseur ne fonctionne pas

Causes possibles	Solutions
Le téléviseur ne s’allume pas	• Allumez l’onduleur, éteignez-le et rallumez-le à nouveau • Contactez le manufacturier de votre téléviseur pour connaître la puissance de surtension nécessaire pour l’allumage et vérifiez s’il est compatible avec une onde sinusoïdale modifiée

DONNÉES TECHNIQUES:

Puissance de sortie continue maximale	3500 W
Crêtes CA maximales	7000 W
Appel de courant sans charge	<0,18A
Onde	sinusoïdale modifiée
Plage de tension d'entrée	20 à 30 VDC
Tension de sortie	110V CA
Fusible	40 ampères (de type fusible de voiture)

CARACTÉRISTIQUES DU CORDON D'ALIMENTATION

Jauge	Type	Quantité
AWG #12	2 fils parallèles (noir/ rouge) avec pinces pour batterie	1 pièce
AWG #12	Câble à connecteur (noir) pour allume-cigarette	1 pièce

GARANTIE

- Votre matériel PowerBright™ est garanti contre tous vices de fabrication pour une année pleine à partir de la date d'achat.
- Cette carte de garantie n'est délivrée que lors du premier achat; elle est strictement personnelle.
- Les dommages causés par un accident, un emploi abusif, des réparations effectuées par l'utilisateur, le sable ou l'eau ne sont pas couverts par cette garantie, qui est seulement valable dans un centre de service PowerBright™.
- Tous les frais postaux ou de transport, y compris l'assurance, sont à la charge du propriétaire, Toutes les autres réclamations, de quelque nature qu'elles soient, ne sont pas couvertes.
- Cette garantie est valable seulement au Canada et aux Etats-Unis.

NOTES

NOTES

PowerBright™

www.PowerBright.com
TOLL FREE: 1.866.295.6775

ML3500-24
POWER INVERTER
ONDULEUR DE COURANT

110 VOLT

MADE IN CHINA

40 Amp 277 VAC 50/60 HZ single pole 0.5” (13 mm) wide

The only information available is the model number and the manufacturer’s website.

Model number: OBB-40-277VAC-DIN
www.outbackpower.com/products/integration_hardware/breakers/

20 Amp 277 VAC 50/60 HZ single pole 0.5” (13 mm) wide

The only information available is the model number and the manufacturer’s website.

Model number: OBB-20-277VAC-DIN
www.outbackpower.com/products/integration_hardware/breakers/

Model Name: Run dry 24vdc

Specifications: View list below

Description: Jabsco pump. For general purpose pumping where self-priming and extended run dry capability are required. Liquid stored in the specially designed pumphead provides 10 minutes or more of run dry operation after liquid supply tank is empty. Heavy duty 24V DC motor. Upgraded carbon-ceramic mechanical shaft seal standard. Do not pump gasoline or other flammable liquids.

Dry running for twenty minutes after initial use.

Model Number: **23920-9313**

Manufacturer: **Jabsco Pumps**

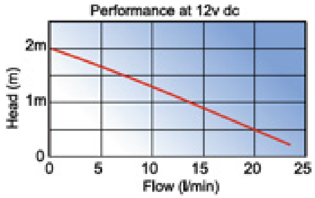
Series: 23920 Run Dry DC Pump

Accessories: Click to see suggested accessories for this product

Price: **$320.00**

BUY

Operating/Maintenance Manual



▲ performance graph enlarge

Specifications of: Run dry 24vdc	
Maximum Flow:	**11 gpm**
TDH Maximum:	**19 feet / 8.23 psi**
Inlet Connection Type:	**FNPT**
Inlet:	**0.75 inches**
Outlet Connection Type:	**FNPT**
Outlet:	**0.75 inches**
Wetted Materials:	**316SS, Bronze**
Elastomers:	**Buna-Nitrile**
Voltage:	**24DC**
Motor:	**TENV**
Motor AMPS:	**15**
Speed:	**1725 RPM**
Self-priming:	**Yes**
Suction Lift:	**4**
Max. Operating Temp.:	**180 °F**
Max. SG:	**1.20**
Viscosity:	**352.00 cp 2000.00 ssu**
Max. Vol. of Susp. Solids:	**1 %**
Max. Particle Size:	**1.00**
Max. Particle Hardness	**0.06**
Shaft:	**304SS**
Length:	**7.50 inches**
pH Low:	**5.00**

pH High:	9.00
Mechanical Seal Type:	Single
Applications:	Flooded Suction, Self-Priming, Contractor, Dewatering, Fuel Oil, Marine
Other:	FLA listed above is the fuse size. Complies with USCG 183.410 and ISO 8846 MARINE (Ignition Protection). ISO 8849 MARINE (Bilge Pump Standard). Size: 7 1/2" X 4 3/4" X 3 1/2"
Usual Ship Time:	3-5 days
Weight:	8.00
Warranty:	1 years

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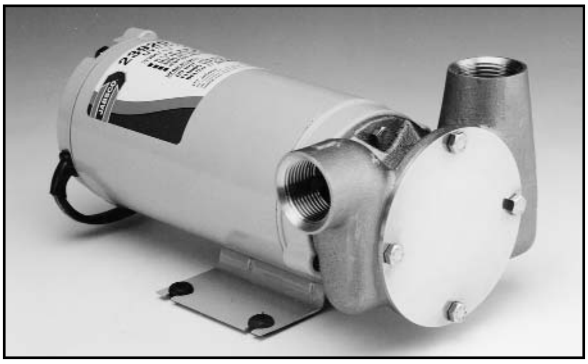


RUN DRY UTILITY PUPPIES

MODELS:
23920-9403 / 9503 12 / 24V RUN DRY UTILITY PUPPY
23920-9213 / 9313 12 / 24V RUN DRY UTILITY PUPPY

FEATURES:

Continuous rated, heavy duty, dry running pumps for bilge, deckwash and general purpose use.

- Meets USCG Regulation 183.410 and ISO 8846 MARINE (Ignition protection).
- ISO 8849 MARINE (Bilge pump standard).
- Bilge debris present no problem to these bronze bodied, flexible impeller pumps.
- Simple design means fewer wearing parts.

Run Dry Utility Puppy 23920-9403 / 9503

- 390 gph output.
- Twenty minutes dry running (after initial prime).
- Self priming to 4 ft.

Run Dry Utility Puppy 23920-9212 / 9313

- 612 gph output.
- Ten minutes dry running (after initial prime).
- Self priming to 8 ft.
- Long life mechanical seal.

RUN DRY UTILITY PUPPY PERFORMANCE

Approximate performance for new pump, pumping water at 20°c, with fully charged battery

Total Manomateric Head	**23920-9403 23920-9503**	**23920-9213 23920-9313**
ftH^{2}O	gpm	gpm
0	10	13.2
3.5	9.6	12.6
7	9.3	12
13	8	10.8
20	6.6	10
26		9
33		8
39		6.6

INSTALLATION INSTRUCTIONS:

Jabsco Utility Puppies can be mounted on any flat surface. Fit the pump in a dry, well ventilated position where there is full access for service. If installed in a vertical position the motor must be above the pump head. Use the rubber grommets provided to minimise vibration, do not overtighten the mounting screws.

¾" NPT threaded fittings should be used to connect 1" i.d. suction and discharge hoses. Secure the hose to the fittings with stainless steel hose clamps. Use spiral reinforced hose (with a smooth internal bore) that will not collapse under suction, or rigid or semi rigid pipework systems. The pipework must be compatible with the liquid being pumped. Pipe runs should be kept as straight and short as possible, avoiding rising and dipping over obstructions. Fit an inlet strainer on the inlet hose to prevent blockage.

⚠ **WARNING:** All marine pumps discharging overboard must be installed with the overboard discharge well above both static and heeled waterlines.

WIRING INSTRUCTIONS

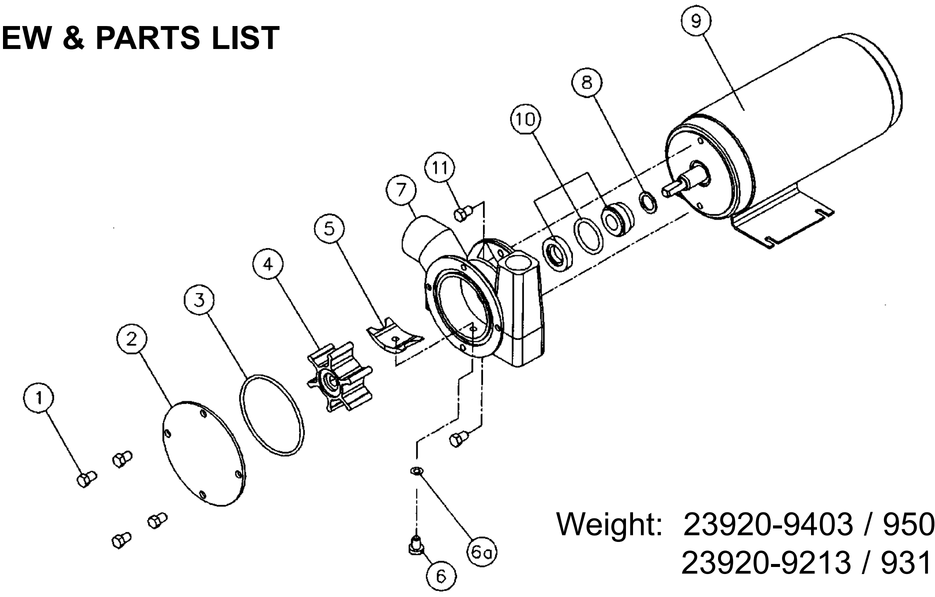
Make all electrical connections in dry locations, connections in humid environments should be sealed to prevent corrosion. Protect the circuit with a correctly sized fuse or circuit breaker in the positive (+) lead as close as possible to the power source. Select the correct cable size from the chart below. Inadequate voltage at the motor terminals when the pump is running (not less than 10% below rated voltage at full load) due to partially discharged batteries or insufficient cable size may result in blowing fuses, failure to start or poor pump performance.

Connect the black motor wire to the negative (-) battery terminal. The red wire should run via a suitably rated switch or circuit breaker to the positive (+) battery terminal.

⚠ **WARNING:** If the fuse fails repeatedly do not fit a heavier fuse or bridge the fuse terminals with silver paper or metal wire. Failure to observe this instruction may result in a fire hazard due to overheating of cables.

ELECTRICAL WIRING INFORMATION					
Model No.	**Voltage**	**Amp Draw**	**Max. Fuse Size**	**Min. Wire Size AWG**	**Max. Length of wire between (+) & (-) battery terminals**
23920-9213	12V	21 amp	25 amp	10 8	up to 20ft over 20 ft
23920-9313	24V	11 amp	15 amp	12 10	up to 20ft over 20 ft
23920-9403	12V	13 amp	15 amp	14	15ft
23920-9503	24V	7.5 amp	10 amp	14	15ft

EXPLODED VIEW & PARTS LIST



Weight: 23920-9403 / 9503 7lb
23920-9213 / 9313 10lb

RUN DRY UTILITY PUPPY PARTS					
KEY	**DESCRIPTION**	**23920-9213 / -9313**		**23920-9403 / -9503**	
		QTY	**PART NUMBER**	**QTY**	**PART NUMBER**
1	End Cover Screws	4	X3001-147F	4	X3001-147F
2	End Cover	1	23825-0000	1	23825-0000
3	End Cover Seal	1	X4020-257A	1	X4020-257A
4	Impeller - Nitrile	1	7273-0003	1	6303-0003
5	Cam	1	53023-0000	1	53023-0100
6	Cam Screw	1	X3002-147F	1	X3002-147F
6a	Cam Screw Seal	1	X4020-105A	1	X4020-105A
7	Pump Body	1	53024-9000	1	53024-9100
8	Slinger	1	6342	1	6342
9	Motor	1		1	
	Standard Impeller 12V		SP8012-0261		SP8012-0165
	Standard Impeller 24V		SP8012-0262		SP8012-0166
10	Mechanical Water Seal	1	SP8012-0301B		
	Lip Type Water Seal			1	SP2701-52
11	Pump Motor Screws	2	X3001-147F	2	X3001-147F

Jabsco

ITT Industries

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JAPAN

Jabsco GmbH, Oststraße 28, 22844 Norderstedt
Tel : +49 (0) 40 53 53 73 0 Fax : +49 (0) 40 53 53 73 11
GERMANY

Warranty: All products of the company are sold and all services of the company are offered subject to the company's warranty and terms and conditions of sale, copies of which will be furnished upon request.

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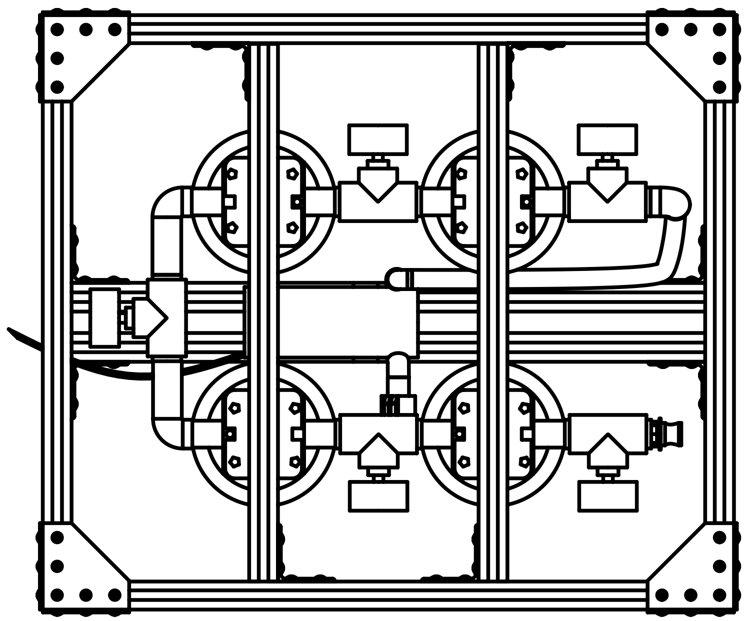
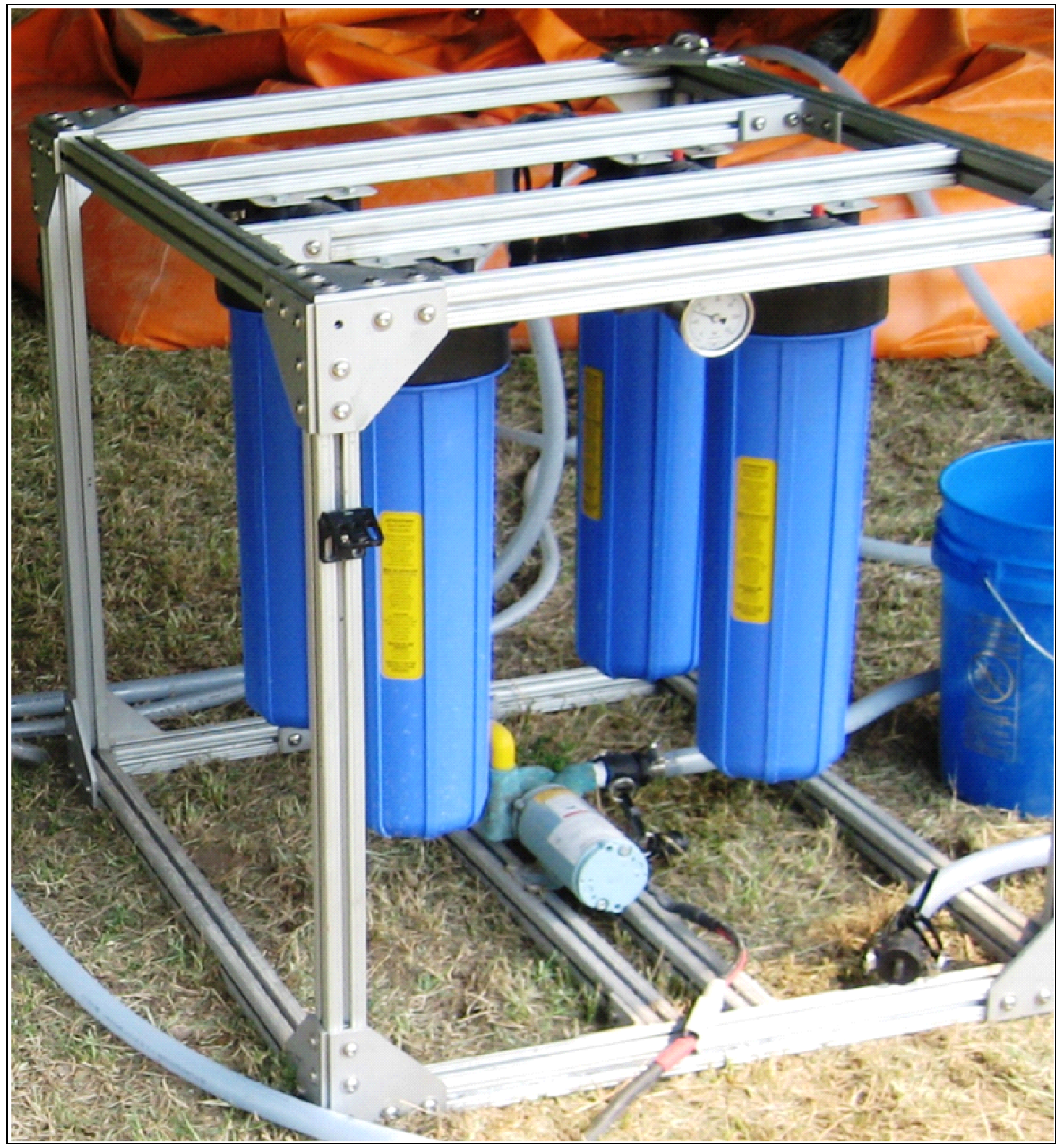
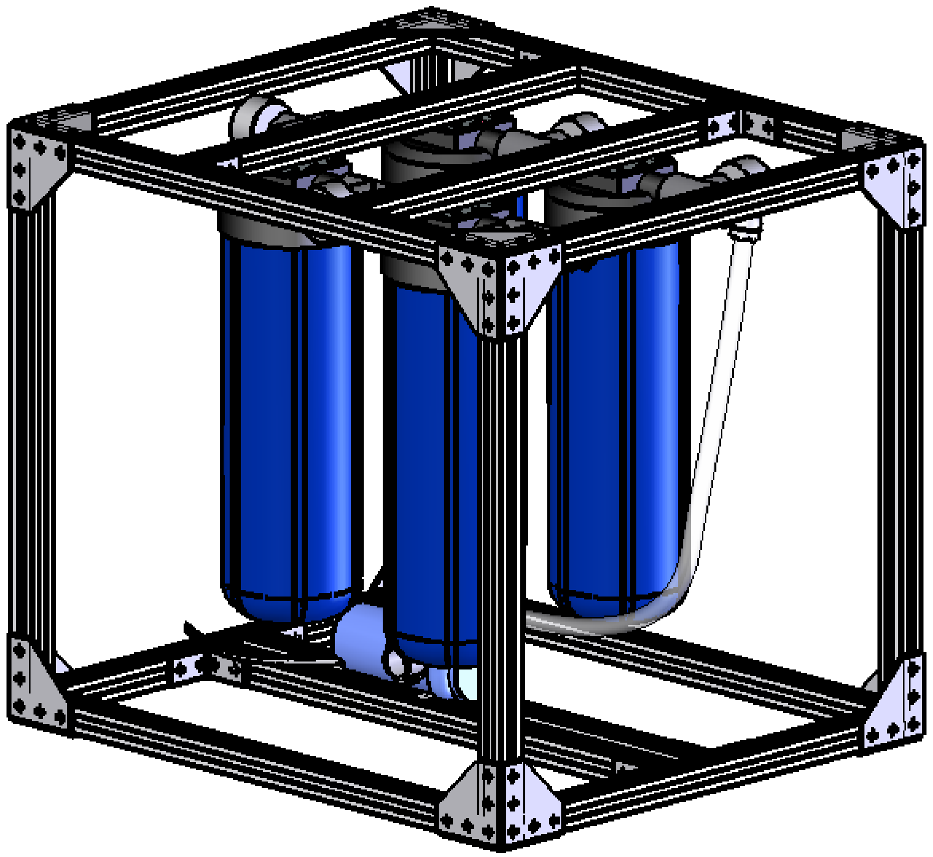


TOP VIEW





DIMETRIC VIEW

arc applied research center
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COMMENTS:
DIMENSIONS ARE IN INCHES

MORE DETAILED COMPONENT INFORMATION IS AVAILABLE IN THE APPENDICES

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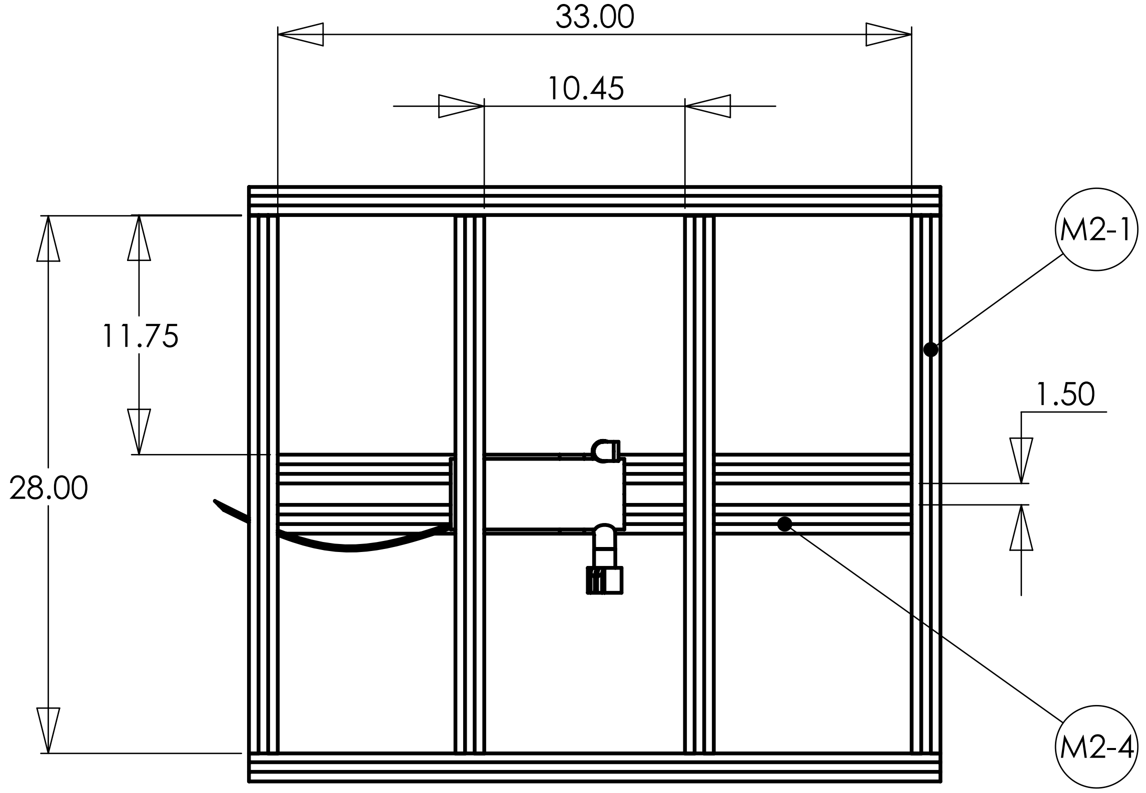
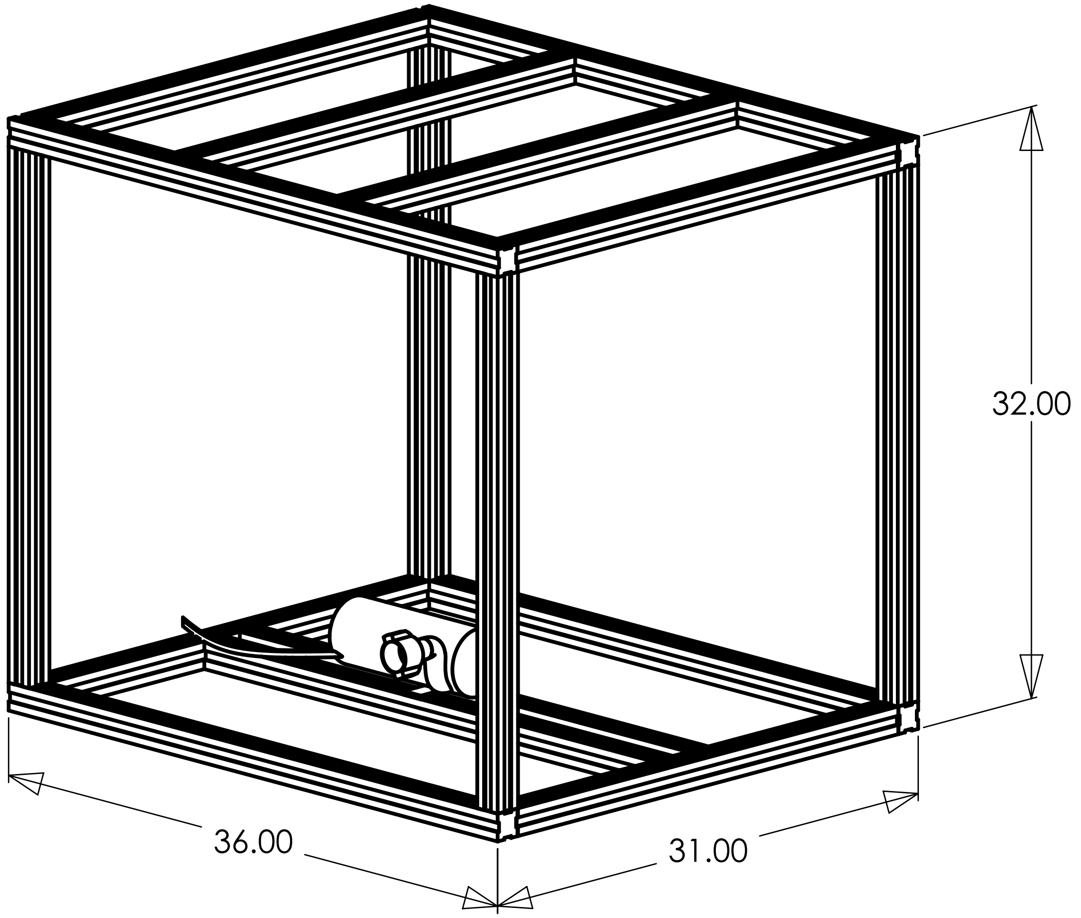
TITLE:
PREFILTRATION
MODULE

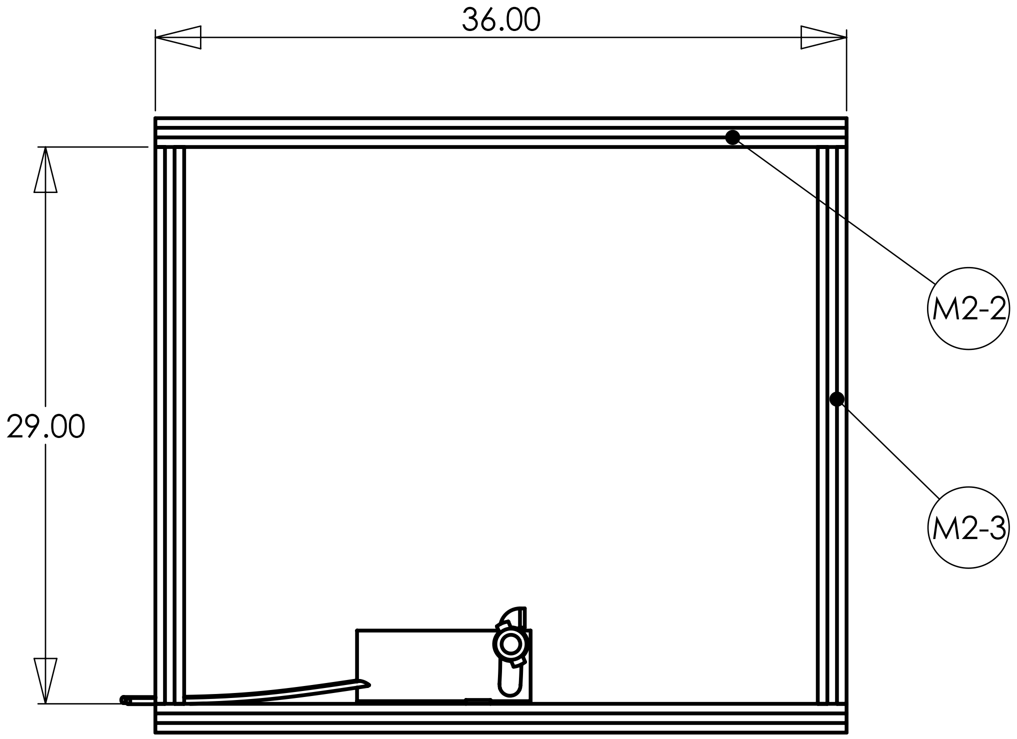
SIZE **B**
DWG. NO. M1
REV
SCALE: NTS
SHEET 1 OF 7



TOP VIEW



DIMETRIC VIEW



FRONT VIEW

ITEM NO.	QTY.	DESCRIPTION	PART NO.
M2-1	6	SLOTTED ALUM FRAMING 1.5 X 1.5 X 28	47065T23
M2-2	4	SLOTTED ALUM FRAMING 1.5 X 1.5 X 36	47065T23
M2-3	4	SLOTTED ALUM FRAMING 1.5 X 1.5 X 29	47065T23
M2-4	2	SLOTTED ALUM FRAMING 1.5 X 1.5 X 33	47065T23

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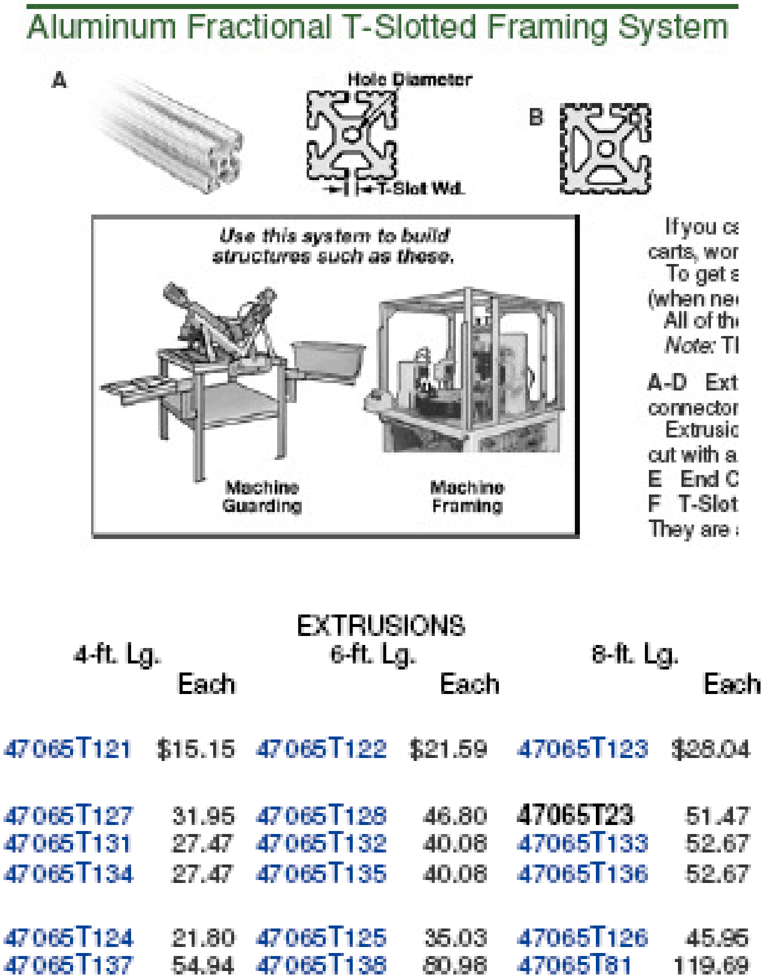
TITLE:
FRAME DETAIL

SIZE
B
DWG. NO.
M2
REV

SCALE: NTS
SHEET 2 OF 7

M2-1 Slotted Aluminum Framing (47065T23)

This material was purchased from McMaster and the ordering information from the website can be seen below. This particular piece was cut to 28.0 inches and was used for the six horizontal bars of the frame.


A
Hole Diameter
T-Slot Wd.
B
Use this system to build structures such as these.
Machine Guarding
Machine Framing

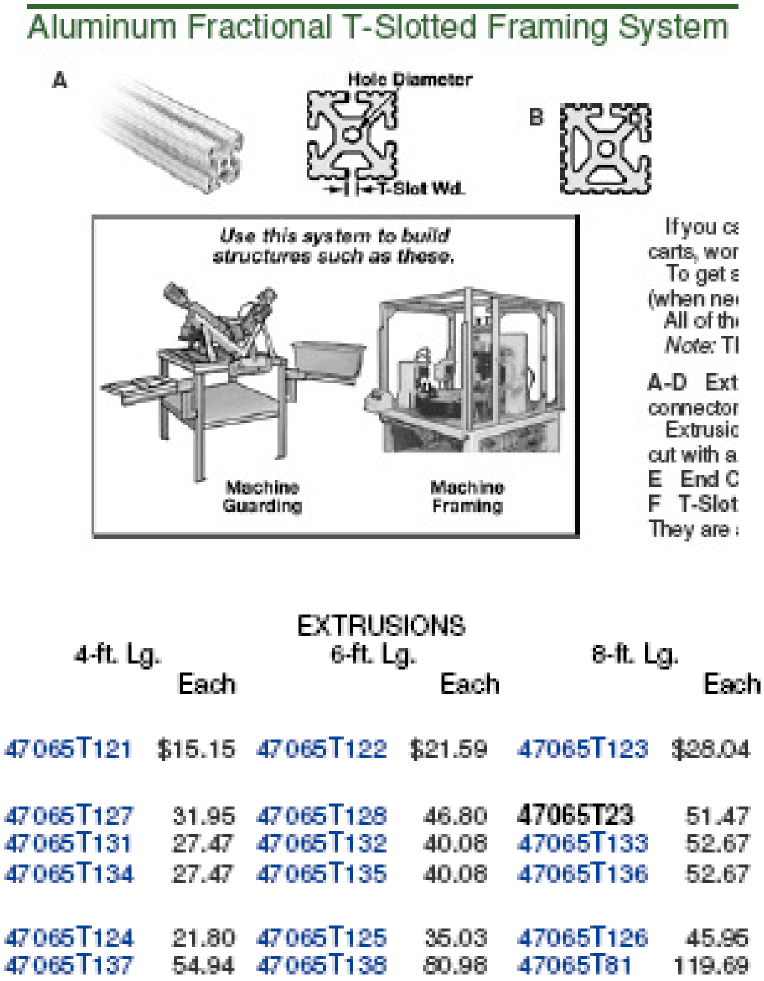
Aluminum Fractional T-Slotted Framing System

If you ca
carts, wor
To get s
(when ne
All of th
Note: Tl
A-D Ext
connector
Extrusic
cut with a
E End C
F T-Slot
They are

EXTRUSIONS					
4-ft. Lg.	Each	6-ft. Lg.	Each	8-ft. Lg.	Each
47065T121	$15.15	47065T122	$21.59	47065T123	$28.04
47065T127	31.95	47065T128	46.80	47065T23	51.47
47065T131	27.47	47065T132	40.08	47065T133	52.67
47065T134	27.47	47065T135	40.08	47065T136	52.67
47065T124	21.80	47065T125	35.03	47065T126	45.95
47065T137	54.94	47065T138	80.98	47065T81	119.69

M2-2 Slotted Aluminum Framing (47065T23)

This material was purchased from McMaster and the ordering information from the website can be seen below. This particular piece was cut to 36.0 inches and was used for the four outer horizontal bars of the frame.


A
Hole Diameter
T-Slot Wd.
B
Use this system to build structures such as these.
Machine Guarding
Machine Framing

Aluminum Fractional T-Slotted Framing System

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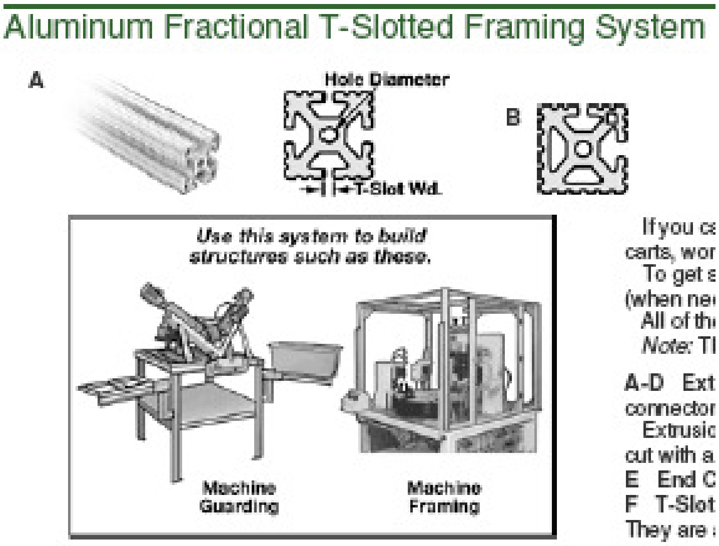
F T-Slot
They are

EXTRUSIONS

4-ft. Lg.	Each	6-ft. Lg.	Each	8-ft. Lg.	Each
47065T121	$15.15	47065T122	$21.59	47065T123	$28.04
47065T127	31.95	47065T128	46.80	**47065T23**	51.47
47065T131	27.47	47065T132	40.08	47065T133	52.67
47065T134	27.47	47065T135	40.08	47065T136	52.67
47065T124	21.80	47065T125	35.03	47065T126	45.95
47065T137	54.94	47065T138	80.98	47065T81	119.69

M2-3 Slotted Aluminum Framing (47065T23)

This material was purchased from McMaster and the ordering information from the website can be seen below. This particular piece was cut to 29.0 inches and was used for the four vertical bars of the frame.



Aluminum Fractional T-Slotted Framing System

A
Hole Diameter
T-Slot Wd.
B
Use this system to build structures such as these.
Machine Guarding
Machine Framing

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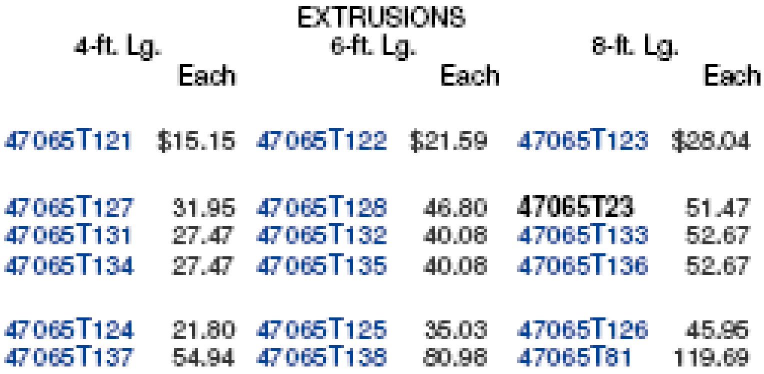
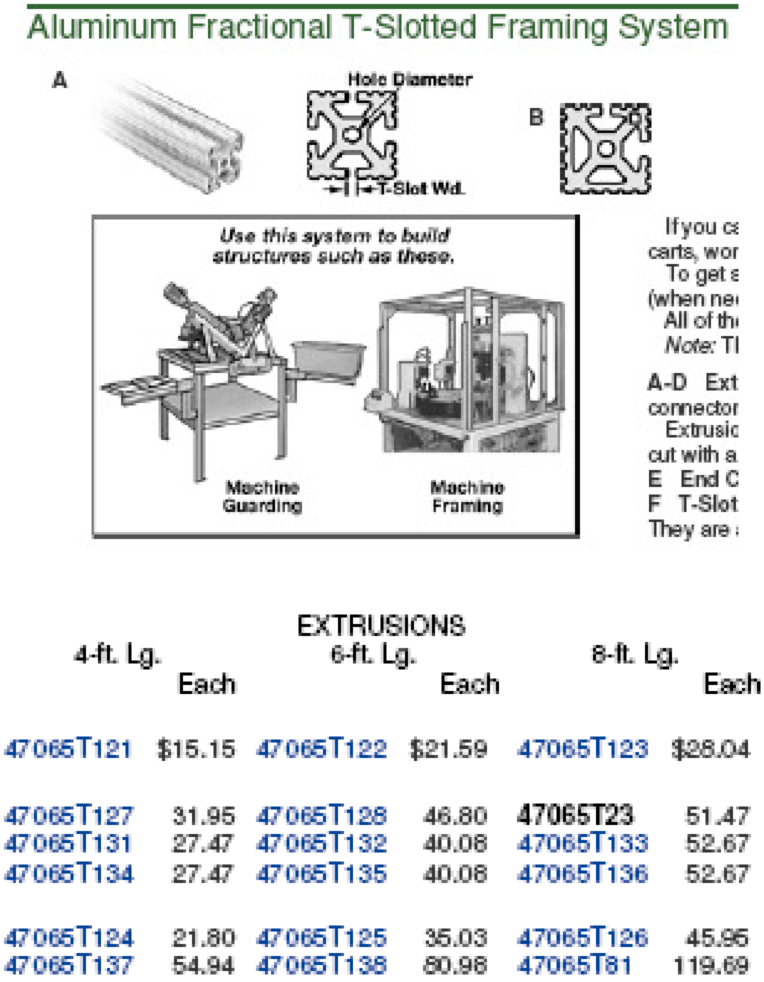


EXTRUSIONS

4-ft. Lg.	Each	6-ft. Lg.	Each	8-ft. Lg.	Each
47065T121	$15.15	47065T122	$21.59	47065T123	$28.04
47065T127	31.95	47065T128	46.80	47065T23	51.47
47065T131	27.47	47065T132	40.08	47065T133	52.67
47065T134	27.47	47065T135	40.08	47065T136	52.67
47065T124	21.80	47065T125	35.03	47065T126	45.95
47065T137	54.94	47065T138	80.98	47065T81	119.69

M2-4 Slotted Aluminum Framing (47065T23)

This material was purchased from McMaster and the ordering information from the website can be seen below. This particular piece was cut to 33.0 inches and was used for the two inner horizontal bars of the frame.


Aluminum Fractional T-Slotted Framing System

A
Hole Diameter
T-Slot Wd.
B
Use this system to build structures such as these.
Machine Guarding
Machine Framing

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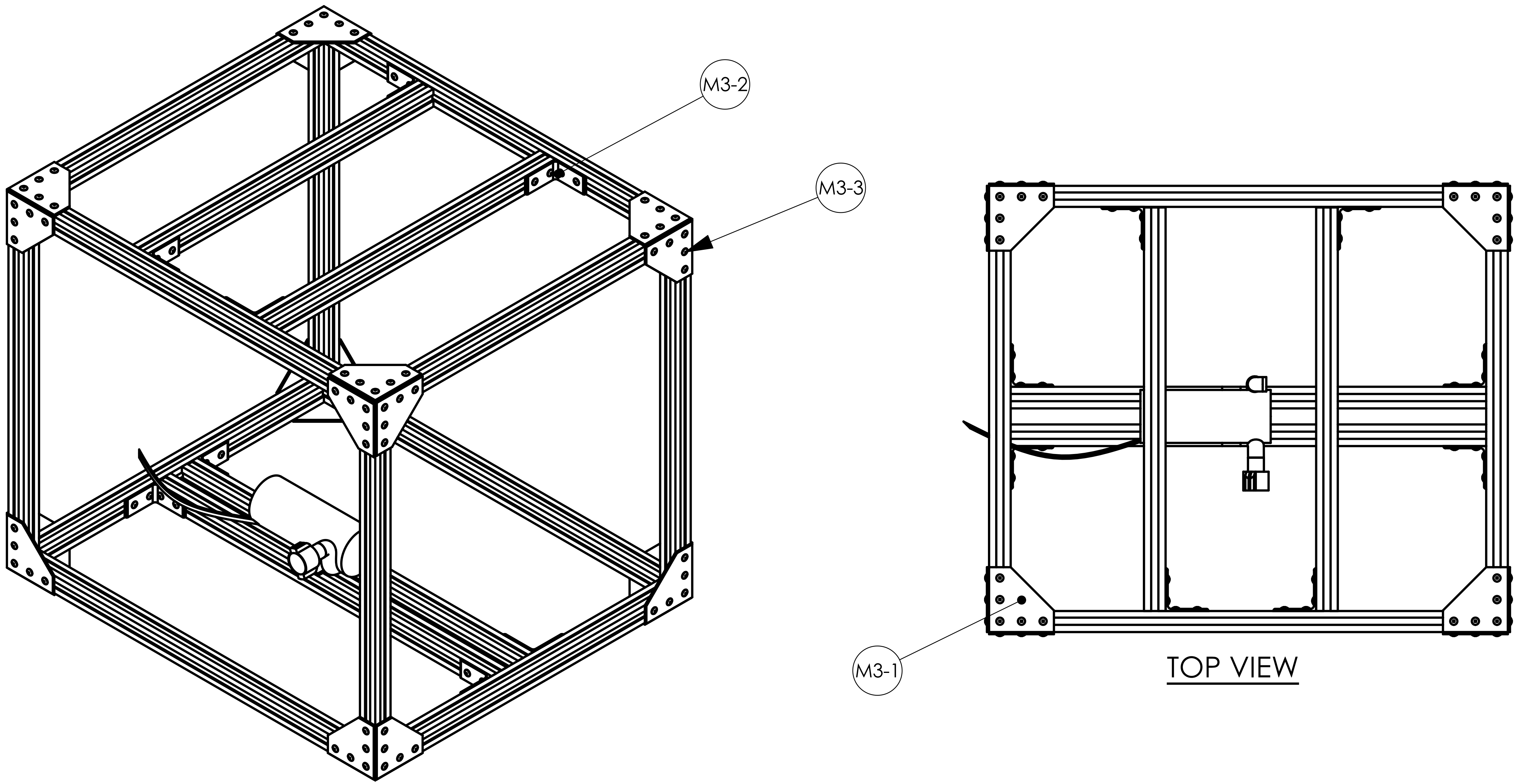
EXTRUSIONS

4-ft. Lg.	Each	6-ft. Lg.	Each	8-ft. Lg.	Each
47065T121	$15.15	47065T122	$21.59	47065T123	$28.04
47065T127	31.95	47065T128	46.80	**47065T23**	51.47
47065T131	27.47	47065T132	40.08	47065T133	52.67
47065T134	27.47	47065T135	40.08	47065T136	52.67
47065T124	21.80	47065T125	35.03	47065T126	45.95
47065T137	54.94	47065T138	80.98	47065T81	119.69



ISOMETRIC VIEW

TOP VIEW

ITEM NO.	QTY.	DESCRIPTION	PART NO.
M3-1	24	FIVE HOLE CORNER CONNECTOR	47065T178
M3-2	8	FOUR HOLE CORNER CONNECTOR	47065T51
M3-3	152	T-NUT WITH CAPSCREW	47065T145

COMMENTS:
DIMENSIONS ARE IN INCHES

MORE DETAILED COMPONENT INFORMATION IS AVAILABLE IN THE APPENDICES

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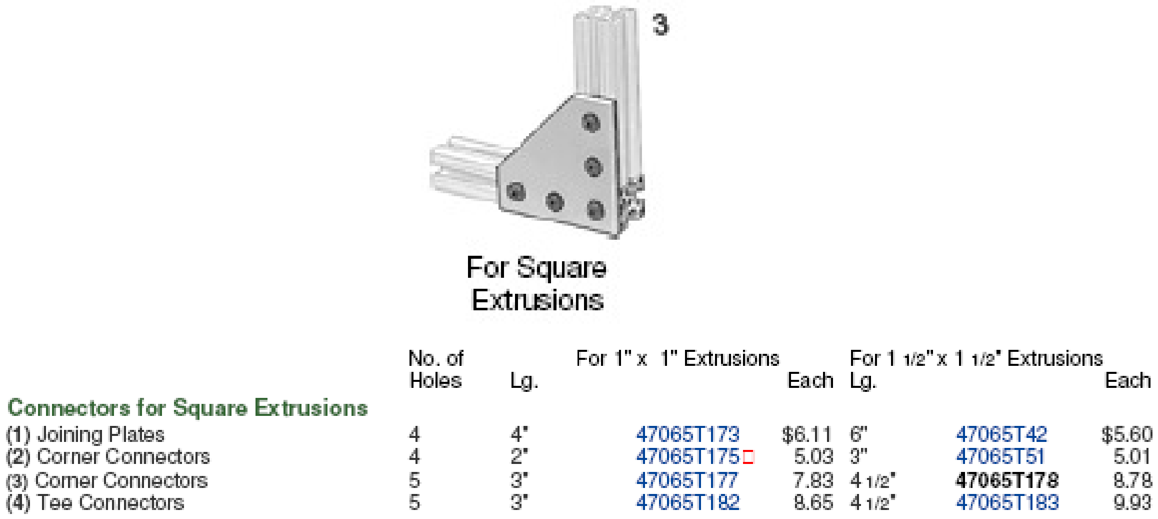
TITLE:
PLATE DETAIL

SIZE **B**
DWG. NO. M3
REV

SCALE: NTS
SHEET 3 OF 7

M3-1 Five Hole Corner Connector (47065T178)

This material was purchased from McMaster and the ordering information from the website can be seen below.

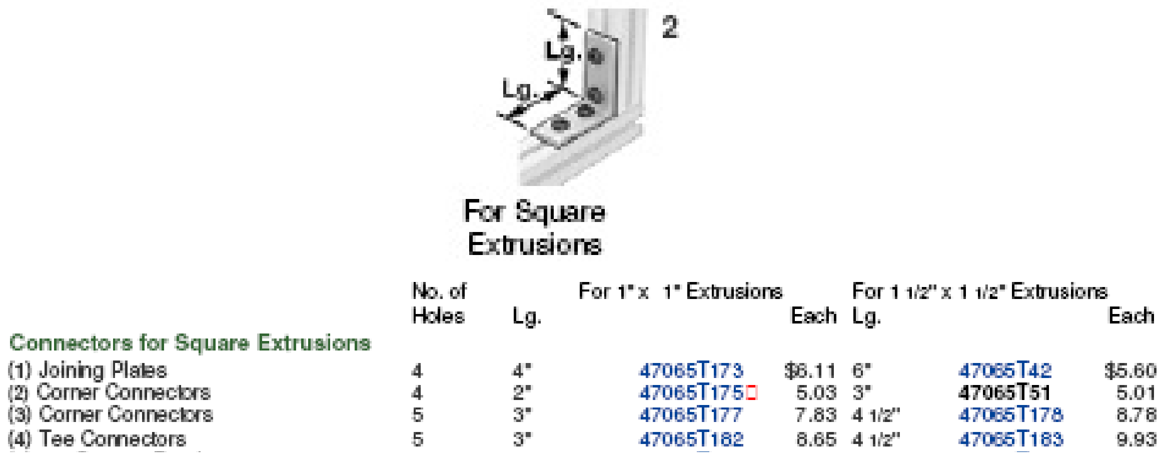


For Square Extrusions

	No. of Holes	Lg.	For 1" x 1" Extrusions	Each	For 1 1/2" x 1 1/2" Extrusions Lg.		Each
Connectors for Square Extrusions							
(1) Joining Plates	4	4"	47065T173	$6.11	6"	47065T42	$5.60
(2) Corner Connectors	4	2"	47065T175	5.03	3"	47065T51	5.01
(3) Corner Connectors	5	3"	47065T177	7.83	4 1/2"	**47065T178**	8.78
(4) Tee Connectors	5	3"	47065T182	8.65	4 1/2"	47065T183	9.93

M3-2 Four Hole Corner Connector (47065T51)

This material was purchased from McMaster and the ordering information from the website can be seen below.

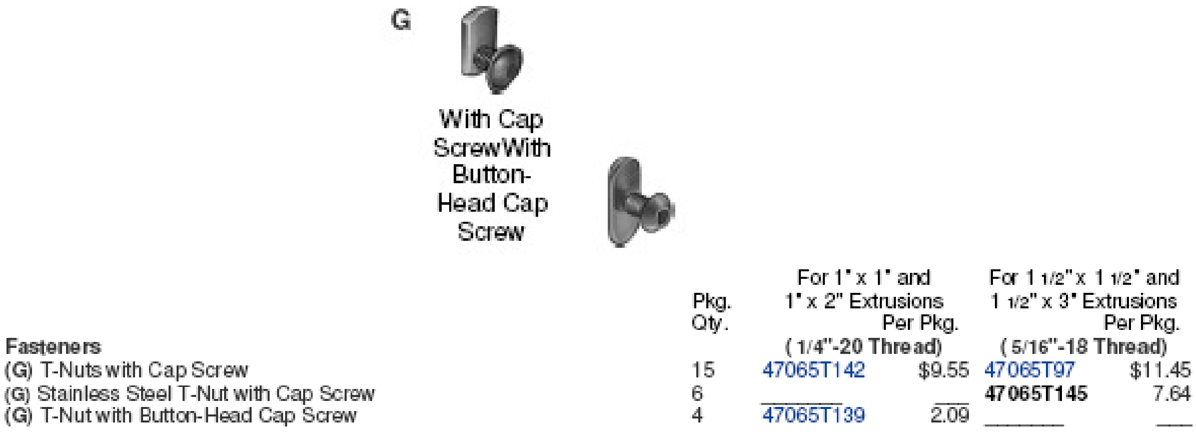


For Square Extrusions

	No. of Holes	For 1" x 1" Extrusions			For 1 1/2" x 1 1/2" Extrusions		
		Lg.		Each	Lg.		Each
Connectors for Square Extrusions							
(1) Joining Plates	4	4"	47065T173	$6.11	6"	47065T42	$5.60
(2) Corner Connectors	4	2"	47065T175☐	5.03	3"	**47065T51**	5.01
(3) Corner Connectors	5	3"	47065T177	7.83	4 1/2"	47065T178	8.76
(4) Tee Connectors	5	3"	47065T182	8.65	4 1/2"	47065T183	9.93

M3-3 T-Nut with Cap screw (47065T145)

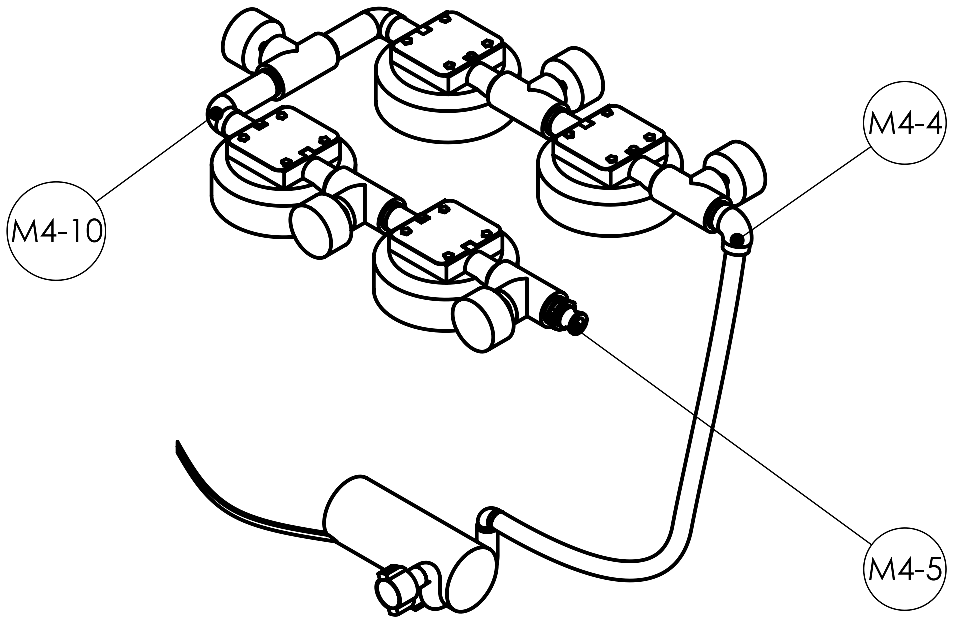
This material was purchased from McMaster and the ordering information from the website can be seen below.



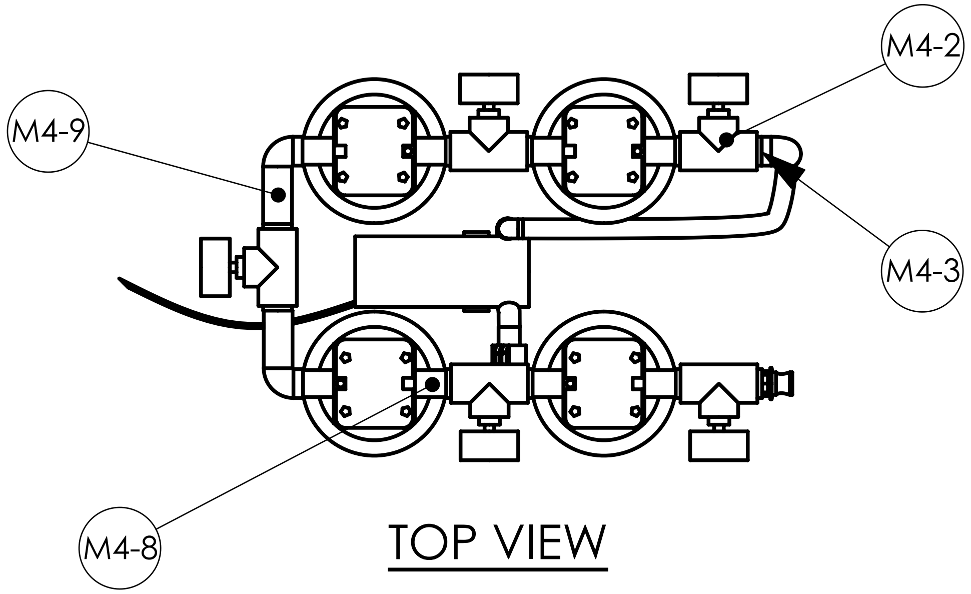
G

With Cap Screw
With Button-Head Cap Screw

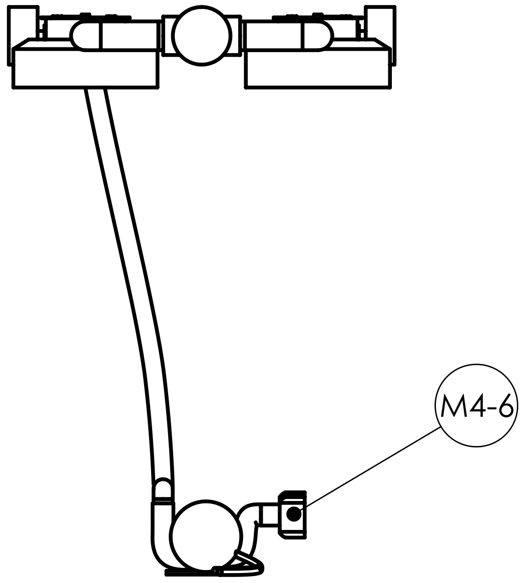
Fasteners	Pkg. Qty.	For 1" x 1" and 1" x 2" Extrusions (1/4"-20 Thread)	Per Pkg.	For 1 1/2" x 1 1/2" and 1 1/2" x 3" Extrusions (5/16"-18 Thread)	Per Pkg.
(G) T-Nuts with Cap Screw	15	47065T142	$9.55	47065T97	$11.45
(G) Stainless Steel T-Nut with Cap Screw	6	_______	___	**47065T145**	7.64
(G) T-Nut with Button-Head Cap Screw	4	47065T139	2.09	_______	___



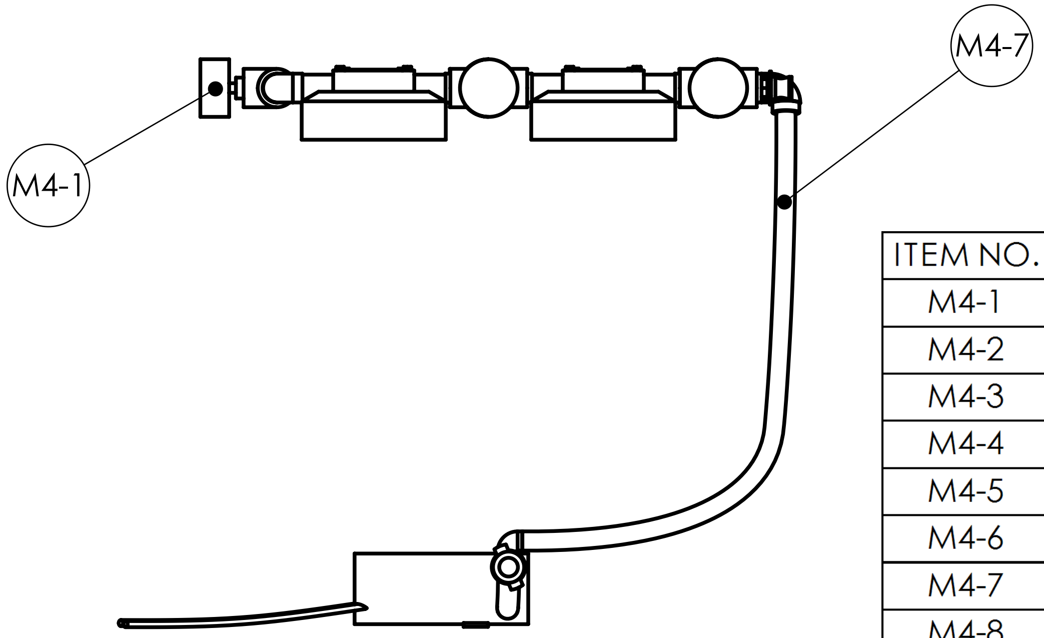
ISOMETRIC VIEW



TOP VIEW



LEFT SIDE VIEW



FRONT VIEW

ITEM NO.	QTY.	DESCRIPTION	PART NO.
M4-1	5	PRESSURE GAUGE	3795K142
M4-2	5	TEE	4596K34
M4-3	6	REDUCING BUSHING	4596K407
M4-4	1	ELBOW BARB	5218K81
M4-5	1	MALE CAMLOCK	5535K59
M4-6	1	FEMALE CAMLOCK	5535K56
M4-7	50'	3/4" HOSE	5238K768
M4-8	6	2" NIPPLE	46825K41
M4-9	2	5.5" NIPPLE	4882K275
M4-10	2	1" ELBOW	46885K124

COMMENTS:
DIMENSIONS ARE IN INCHES

MORE DETAILED COMPONENT
INFORMATION IS AVAILABLE IN
THE APPENDICES

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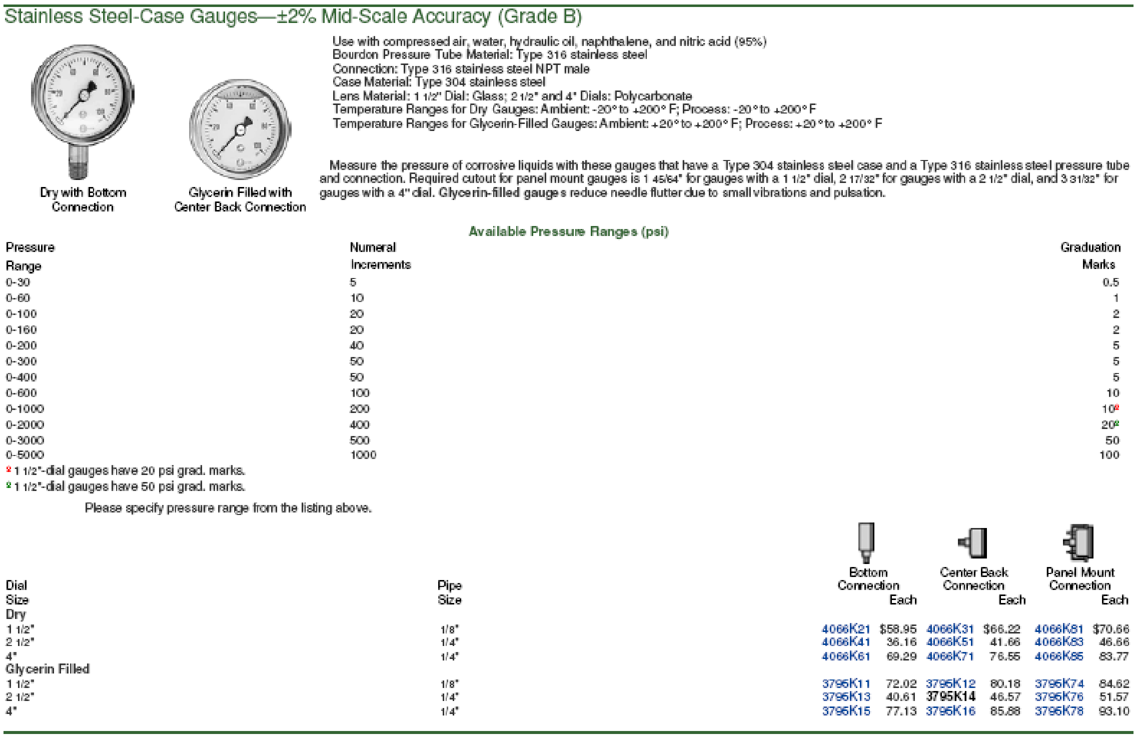
TITLE:
PLUMBING
DETAIL

SIZE **B**
DWG. NO. M4
REV

SCALE: NTS
SHEET 4 OF 7

M4-1 Pressure Gauge (3795T142)

This material was purchased from McMaster and the ordering information from the website can be seen below.



Stainless Steel-Case Gauges—±2% Mid-Scale Accuracy (Grade B)

Dry with Bottom Connection

Glycerin Filled with Center Back Connection

Use with compressed air, water, hydraulic oil, naphthalene, and nitric acid (95%)
Bourdon Pressure Tube Material: Type 316 stainless steel
Connection: Type 316 stainless steel NPT male
Case Material: Type 304 stainless steel
Lens Material: 1 1/2" Dial: Glass; 2 1/2" and 4" Dials: Polycarbonate
Temperature Ranges for Dry Gauges: Ambient: -20° to +200° F; Process: -20° to +200° F
Temperature Ranges for Glycerin-Filled Gauges: Ambient: +20° to +200° F; Process: +20° to +200° F

Measure the pressure of corrosive liquids with these gauges that have a Type 304 stainless steel case and a Type 316 stainless steel pressure tube and connection. Required cutout for panel mount gauges is 1 45/64" for gauges with a 1 1/2" dial, 2 17/32" for gauges with a 2 1/2" dial, and 3 31/32" for gauges with a 4" dial. Glycerin-filled gauges reduce needle flutter due to small vibrations and pulsation.

Available Pressure Ranges (psi)

Pressure Range	Numeral Increments	Graduation Marks
0-30	5	0.5
0-60	10	1
0-100	20	2
0-160	20	2
0-200	40	5
0-300	50	5
0-400	50	5
0-600	100	10
0-1000	200	10‡
0-2000	400	20‡
0-3000	500	50
0-5000	1000	100

‡ 1 1/2"-dial gauges have 20 psi grad. marks.
‡ 1 1/2"-dial gauges have 50 psi grad. marks.

Please specify pressure range from the listing above.

Dial Size	Pipe Size	Bottom Connection	Each	Center Back Connection	Each	Panel Mount Connection	Each
Dry							
1 1/2"	1/8"	4066K21	$58.95	4066K31	$66.22	4066K81	$70.66
2 1/2"	1/4"	4066K41	36.16	4066K51	41.66	4066K83	46.66
4"	1/4"	4066K61	69.29	4066K71	76.55	4066K85	83.77
Glycerin Filled							
1 1/2"	1/8"	3795K11	72.02	3795K12	80.18	3795K74	84.62
2 1/2"	1/4"	3795K13	40.61	**3795K14**	46.57	3795K76	51.57
4"	1/4"	3795K15	77.13	3795K16	85.88	3795K78	93.10

Plastic Pipe Fittings and Pipe

Part Number: **4596K34** $6.48 Each

Pipe Size	1"
Shape	Tee
Tee Type Pipe to Pipe	Standard Tee
Schedule	80
System of Measurement	Inch
Pipe to Pipe Connection	NPT x NPT
Material	PVC
Maximum Pressure Note	Not rated for maximum pressure.
Color	Dark Gray
Temperature Range	Up to 140° F
Specifications Met	American Society for Testing and Materials (ASTM), National Sanitation Foundation (NSF)
ASTM Specification	ASTM D2464, ASTM D2467
NSF Specification	NSF 61
WARNING	Never use plastic pipe fittings with compressed air or gas.

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Plastic Pipe Fittings and Pipe

Part Number: **4596K407** $4.61 Each

Pipe Size	1" reduced to 1/4"
Shape	Bushing
Bushing Type	Reducing Hex Bushing (Male x Female)
Schedule	80
System of Measurement	Inch
Pipe to Pipe Connection	NPT x NPT
Material	PVC
Maximum Pressure Note	Not rated for maximum pressure.
Color	Dark Gray
Temperature Range	Up to 140° F
Specifications Met	American Society for Testing and Materials (ASTM), National Sanitation Foundation (NSF)
ASTM Specification	ASTM D2464, ASTM D2467
NSF Specification	NSF 61
WARNING	Never use plastic pipe fittings with compressed air or gas.

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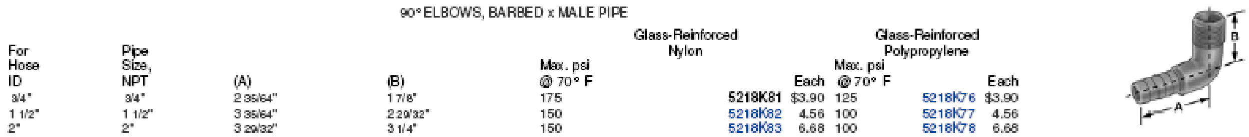
M4-4 Elbow Barb (5218T81)

This material was purchased from McMaster and the ordering information from the website can be seen below.



90° ELBOWS, BARBED x MALE PIPE

					Glass-Reinforced Nylon			Glass-Reinforced Polypropylene	
For Hose ID	Pipe Size, NPT	(A)	(B)	Max. psi @ 70° F		Each	Max. psi @ 70° F		Each
3/4"	3/4"	2 35/64"	1 7/8"	175	5218K81	$3.90	125	5218K76	$3.90
1 1/2"	1 1/2"	3 35/64"	2 29/32"	150	5218K82	4.56	100	5218K77	4.56
2"	2"	3 29/32"	3 1/4"	150	5218K83	6.68	100	5218K78	6.68

Plastic Pipe Fittings and Pipe

Part Number: **5535K59** $2.18 Each

Pipe Size	3/4"
Shape	Pipe to Hose Adapter
Cam and Groove Hose Fitting Shape	Male End Adapter
System of Measurement	Inch
For Hose ID	1-1/4"
Pipe to Hose Connection	NPT Pipe x Cam and Groove Hose
Material	Polypropylene
Material Type	Glass-Fiber Reinforced
Maximum Pressure (psi)	125
Maximum Pressure Note	Maximum pressure is rated at 72° F.
Temperature Range	-30° to +150° F
Specifications Met	Not Rated

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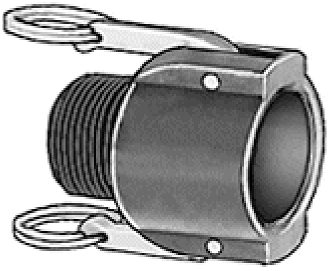
Plastic Pipe Fittings and Pipe



Part Number: **5535K56** $4.76 Each

Pipe Size	3/4"
Shape	Pipe to Hose Adapter
Cam and Groove Hose Fitting Shape	Male End Coupler
System of Measurement	Inch
For Hose ID	1-1/4"
Pipe to Hose Connection	NPT Pipe x Cam and Groove Hose
Material	Polypropylene
Material Type	Glass-Fiber Reinforced
Maximum Pressure (psi)	125
Maximum Pressure Note	Maximum pressure is rated at 72° F.
Temperature Range	-30° to +150° F
Specifications Met	Not Rated
Body Type	Standard Body

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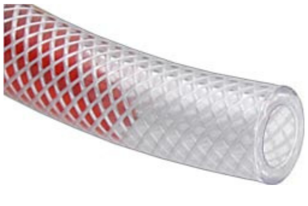
Tubing



Part Number: **5238K768**

1-99 Ft. $1.42 per Ft.
100 or more $1.22 per Ft.

Type	High-Pressure Clear PVC Tubing
Material	PVC
Shape	Single Line
Outside Dia.	1-1/8" (1.125")
Inside Dia.	3/4" (.75")
Wall Thickness	3/16" (.1875")
Available Lengths	10, 25, 50, and 100 feet
Reinforcement	Braid-Reinforced
Color	Clear
Maximum Pressure	200 psi @ 70º F
Operating Temperature Range	+25º to +150º F
Bend Radius	5-1/2" (5.5")
Durometer	73A (Firm)
Tensile Strength	2,465 psi
For Use With	Air, Beverage, Deionized Water, Food, Water
Sterilize With	Not Rated
Specifications Met	United States Food and Drug Administration (FDA)
FDA Specification	CFR21 170-199
Compatible Fittings	Barbed

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Plastic Pipe Fittings and Pipe

Part Number: **46825K41** $2.04 Each

Pipe Size	1"
Shape	Nipple
Nipple Type	Hex Nipple
Schedule	80
System of Measurement	Inch
Pipe to Pipe Connection	NPT x NPT
Material	Polypropylene
Maximum Pressure (psi)	150
Maximum Pressure Note	Maximum pressure is rated at 70° F.
Length	2"
Color	Black
Nipple Threading	Fully Threaded
Temperature Range	-20° to +150° F
Specifications Met	Not Rated
Note	Pipe tape on threads not recommended.
WARNING	Never use plastic pipe fittings with compressed air or gas.

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Plastic Pipe Fittings and Pipe

Part Number: **4882K275**	$2.98 Each
Pipe Size	1"
Shape	Nipple
Nipple Type	Standard Nipple
Schedule	80
System of Measurement	Inch
Pipe to Pipe Connection	NPT x NPT
Material	PVC
Maximum Pressure (psi)	315
Maximum Pressure Note	Maximum pressure is rated at 73° F.
Length	5-1/2"
Color	Dark Gray
Nipple Threading	Threaded Both Ends
Temperature Range	Up to 110° F
Specifications Met	Not Rated
WARNING	Never use plastic pipe fittings with compressed air or gas.

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Plastic Pipe Fittings and Pipe

Part Number: **46885K124** $4.80 Each

Pipe Size	1"
Shape	Elbow
Elbow Type Pipe to Pipe	Male x Female 90° Elbow
Schedule	80
System of Measurement	Inch
Pipe to Pipe Connection	NPT x NPT
Material	Polypropylene
Maximum Pressure (psi)	150
Maximum Pressure Note	Maximum pressure is rated at 70° F.
Color	Black
Temperature Range	-20° to +150° F
Specifications Met	Not Rated
Note	Pipe tape on threads not recommended.
WARNING	Never use plastic pipe fittings with compressed air or gas.

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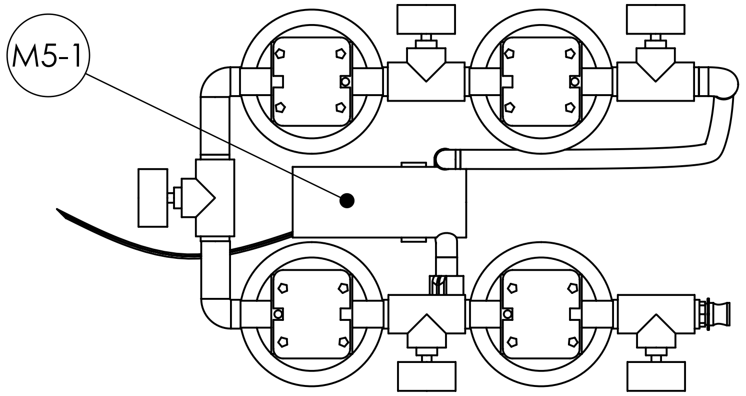
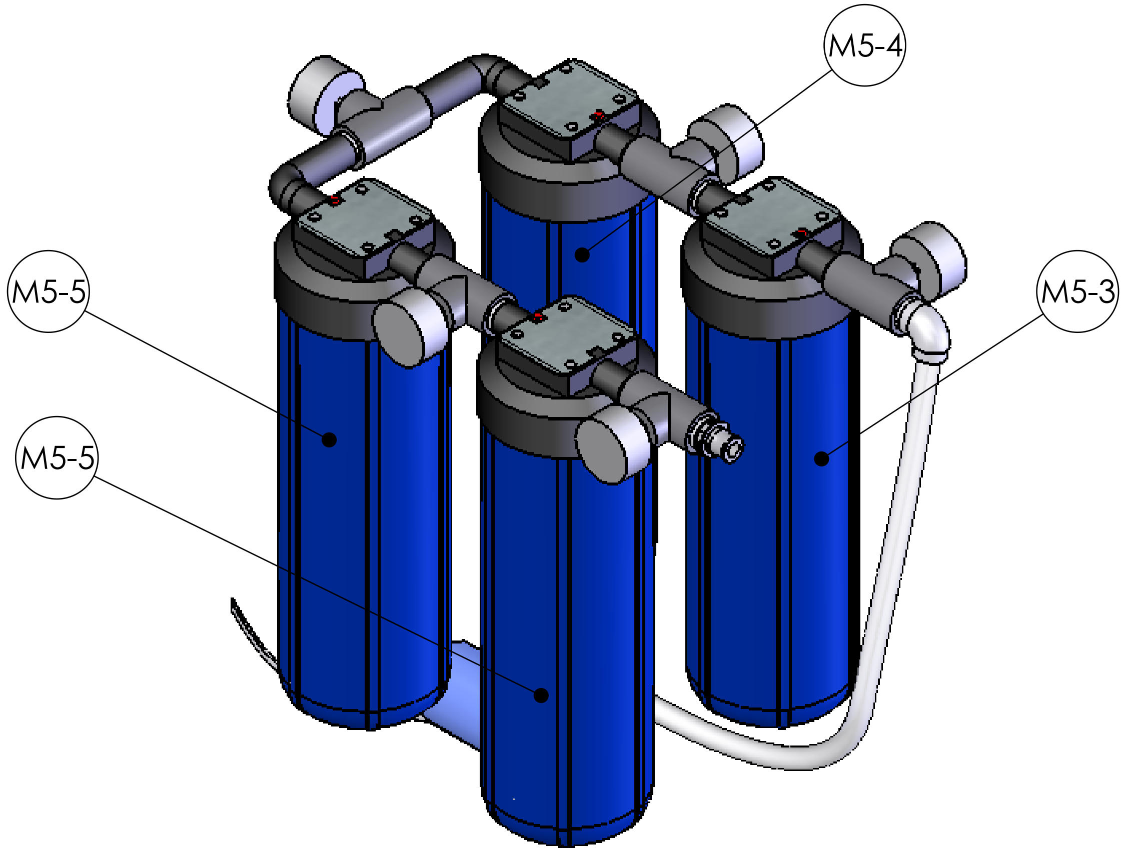
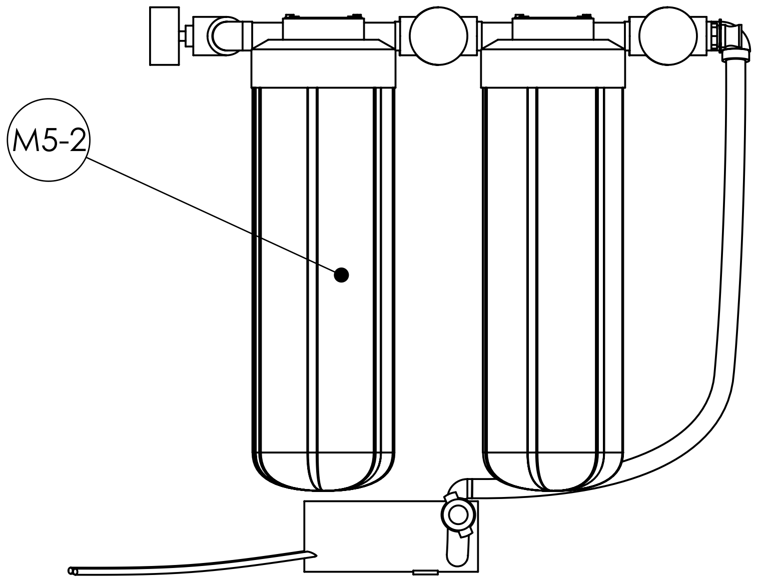


TOP VIEW





FRONT VIEW

ITEM NO.	QTY.	DESCRIPTION	PART NO.
M5-1	1	FEED PUMP	23920-9313
M5-2	4	FILTER HOUSING	HBB-20-1-WPR
M5-3	1	5 MICRON FILTER	HB-20-5W
M5-4	1	20 MICRON FILTER	HB-20-20W
M5-5	2	CARBON FILTER	HAC-BB-20-W

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COMMENTS:
DIMENSIONS ARE IN INCHES

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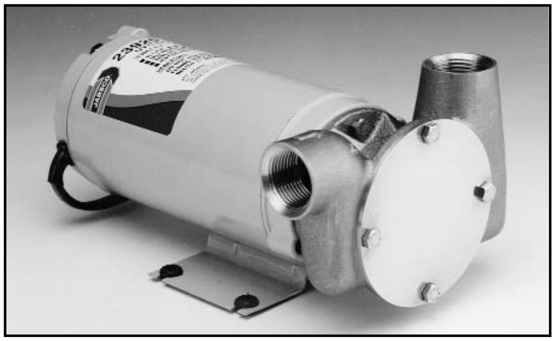
TITLE:
MECHANICAL DETAIL

SIZE **B**
DWG. NO. M5
REV
SCALE: NTS
SHEET 5 OF 7



JABSCO®

RUN DRY
UTILITY PUPPIES

MODELS:
23920-9403 / 9503 12 / 24V RUN DRY UTILITY PUPPY
23920-9213 / 9313 12 / 24V RUN DRY UTILITY PUPPY

FEATURES:

Continuous rated, heavy duty, dry running pumps for bilge, deckwash and general purpose use.

- Meets USCG Regulation 183.410 and ISO 8846 MARINE (Ignition protection).
- ISO 8849 MARINE (Bilge pump standard).
- Bilge debris present no problem to these bronze bodied, flexible impeller pumps.
- Simple design means fewer wearing parts.

Run Dry Utility Puppy 23920-9403 / 9503

- 390 gph output.
- Twenty minutes dry running (after initial prime).
- Self priming to 4 ft.

Run Dry Utility Puppy 23920-9212 / 9313

- 612 gph output.
- Ten minutes dry running (after initial prime).
- Self priming to 8 ft.
- Long life mechanical seal.

RUN DRY UTILITY PUPPY PERFORMANCE

Approximate performance for new pump, pumping water at 20°c, with fully charged battery

Total Manomateric Head	**23920-9403 23920-9503**	**23920-9213 23920-9313**
ftH²O	gpm	gpm
0	10	13.2
3.5	9.6	12.6
7	9.3	12
13	8	10.8
20	6.6	10
26		9
33		8
39		6.6

INSTALLATION INSTRUCTIONS:

Jabsco Utility Puppies can be mounted on any flat surface. Fit the pump in a dry, well ventilated position where there is full access for service. If installed in a vertical position the motor must be above the pump head. Use the rubber grommets provided to minimise vibration, do not overtighten the mounting screws.

¾" NPT threaded fittings should be used to connect 1" i.d. suction and discharge hoses. Secure the hose to the fittings with stainless steel hose clamps. Use spiral reinforced hose (with a smooth internal bore) that will not collapse under suction, or rigid or semi rigid pipework systems. The pipework must be compatible with the liquid being pumped. Pipe runs should be kept as straight and short as possible, avoiding rising and dipping over obstructions. Fit an inlet strainer on the inlet hose to prevent blockage.

⚠ **WARNING:** All marine pumps discharging overboard must be installed with the overboard discharge well above both static and heeled waterlines.

WIRING INSTRUCTIONS

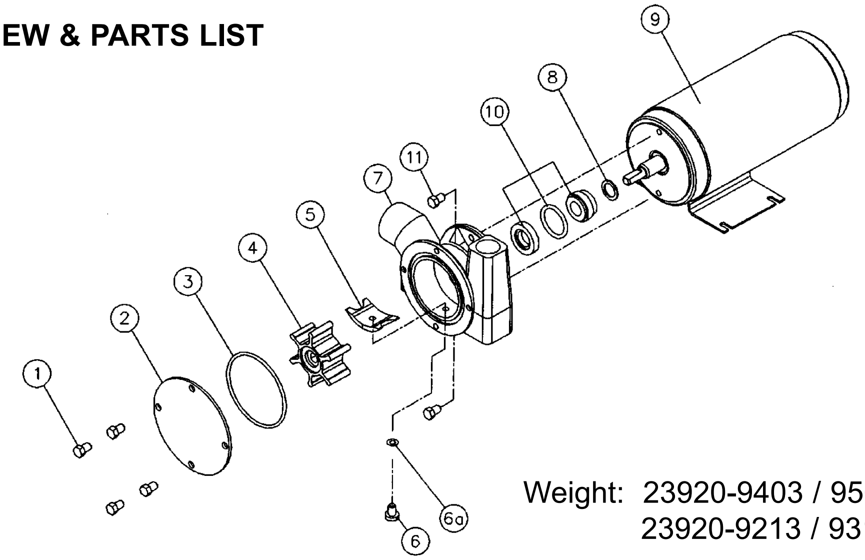
Make all electrical connections in dry locations, connections in humid environments should be sealed to prevent corrosion. Protect the circuit with a correctly sized fuse or circuit breaker in the positive (+) lead as close as possible to the power source. Select the correct cable size from the chart below. Inadequate voltage at the motor terminals when the pump is running (not less than 10% below rated voltage at full load) due to partially discharged batteries or insufficient cable size may result in blowing fuses, failure to start or poor pump performance.

Connect the black motor wire to the negative (-) battery terminal. The red wire should run via a suitably rated switch or circuit breaker to the positive (+) battery terminal.

⚠ **WARNING:** If the fuse fails repeatedly do not fit a heavier fuse or bridge the fuse terminals with silver paper or metal wire. Failure to observe this instruction may result in a fire hazard due to overheating of cables.

ELECTRICAL WIRING INFORMATION					
Model No.	**Voltage**	**Amp Draw**	**Max. Fuse Size**	**Min. Wire Size AWG**	**Max. Length of wire between (+) & (-) battery terminals**
23920-9213	12V	21 amp	25 amp	10 8	up to 20ft over 20 ft
23920-9313	24V	11 amp	15 amp	12 10	up to 20ft over 20 ft
23920-9403	12V	13 amp	15 amp	14	15ft
23920-9503	24V	7.5 amp	10 amp	14	15ft

EXPLODED VIEW & PARTS LIST



Weight: 23920-9403 / 9503 7lb
23920-9213 / 9313 10lb

RUN DRY UTILITY PUPPY PARTS					
KEY	**DESCRIPTION**	**23920-9213 / -9313**		**23920-9403 / -9503**	
		QTY	**PART NUMBER**	**QTY**	**PART NUMBER**
1	End Cover Screws	4	X3001-147F	4	X3001-147F
2	End Cover	1	23825-0000	1	23825-0000
3	End Cover Seal	1	X4020-257A	1	X4020-257A
4	Impeller - Nitrile	1	7273-0003	1	6303-0003
5	Cam	1	53023-0000	1	53023-0100
6	Cam Screw	1	X3002-147F	1	X3002-147F
6a	Cam Screw Seal	1	X4020-105A	1	X4020-105A
7	Pump Body	1	53024-9000	1	53024-9100
8	Slinger	1	6342	1	6342
9	Motor Standard Impeller 12V Standard Impeller 24V	1	 SP8012-0261 SP8012-0262	1	 SP8012-0165 SP8012-0166
10	Mechanical Water Seal	1	SP8012-0301B		
	Lip Type Water Seal			1	SP2701-52
11	Pump Motor Screws	2	X3001-147F	2	X3001-147F

Jabsco

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Warranty: All products of the company are sold and all services of the company are offered subject to the company's warranty and terms and conditions of sale, copies of which will be furnished upon request.

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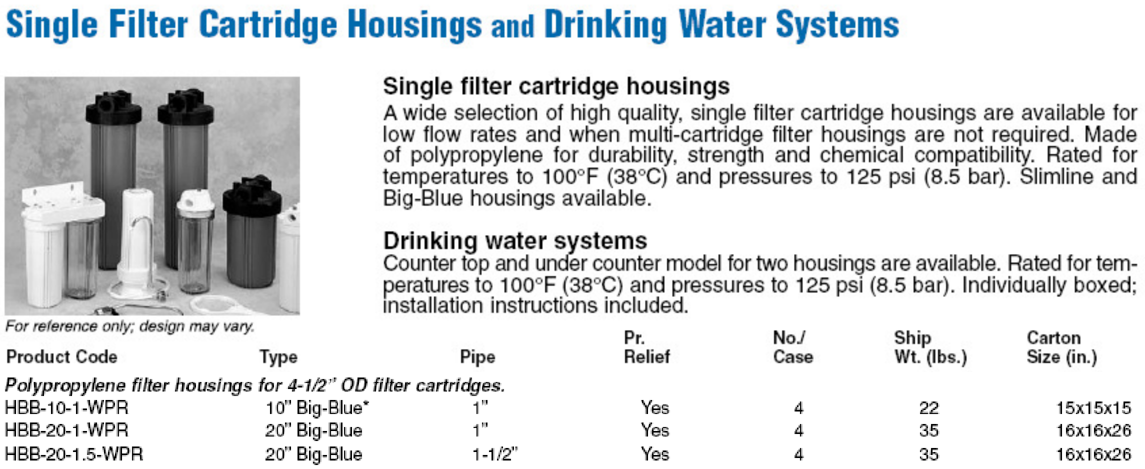
M5-2 Filter Housing (HBB-20-1-WPR)

This material was purchased from a Harmsco Distributer. Product information can be seen below.



Single Filter Cartridge Housings and Drinking Water Systems

For reference only; design may vary.

Single filter cartridge housings

A wide selection of high quality, single filter cartridge housings are available for low flow rates and when multi-cartridge filter housings are not required. Made of polypropylene for durability, strength and chemical compatibility. Rated for temperatures to 100°F (38°C) and pressures to 125 psi (8.5 bar). Slimline and Big-Blue housings available.

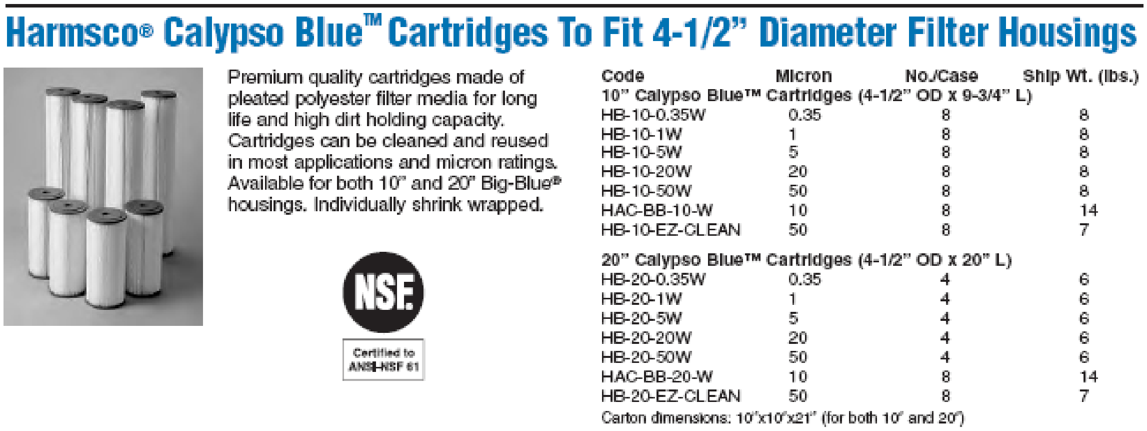
Drinking water systems

Counter top and under counter model for two housings are available. Rated for temperatures to 100°F (38°C) and pressures to 125 psi (8.5 bar). Individually boxed; installation instructions included.

Product Code	Type	Pipe	Pr. Relief	No./ Case	Ship Wt. (lbs.)	Carton Size (in.)
Polypropylene filter housings for 4-1/2" OD filter cartridges.						
HBB-10-1-WPR	10" Big-Blue*	1"	Yes	4	22	15x15x15
HBB-20-1-WPR	20" Big-Blue	1"	Yes	4	35	16x16x26
HBB-20-1.5-WPR	20" Big-Blue	1-1/2"	Yes	4	35	16x16x26

M5-3 5 Micron Filter (HBB-20-5W)

This material was purchased from a Harmsco Distributer. Product information can be seen below.



Harmsco® Calypso Blue™ Cartridges To Fit 4-1/2" Diameter Filter Housings

Premium quality cartridges made of pleated polyester filter media for long life and high dirt holding capacity. Cartridges can be cleaned and reused in most applications and micron ratings. Available for both 10" and 20" Big-Blue® housings. Individually shrink wrapped.

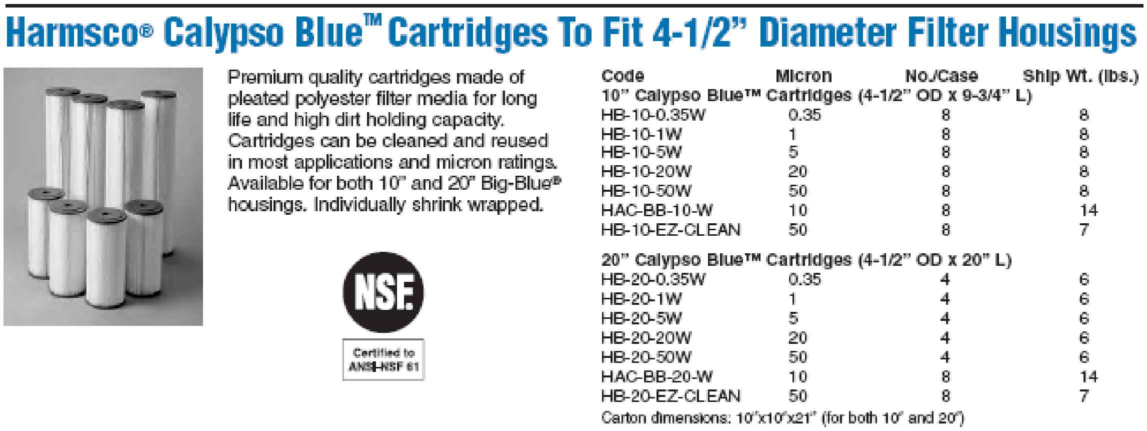
Certified to ANSI-NSF 61

Code	Micron	No./Case	Ship Wt. (lbs.)
10" Calypso Blue™ Cartridges (4-1/2" OD x 9-3/4" L)			
HB-10-0.35W	0.35	8	8
HB-10-1W	1	8	8
HB-10-5W	5	8	8
HB-10-20W	20	8	8
HB-10-50W	50	8	8
HAC-BB-10-W	10	8	14
HB-10-EZ-CLEAN	50	8	7
20" Calypso Blue™ Cartridges (4-1/2" OD x 20" L)			
HB-20-0.35W	0.35	4	6
HB-20-1W	1	4	6
HB-20-5W	5	4	6
HB-20-20W	20	4	6
HB-20-50W	50	4	6
HAC-BB-20-W	10	8	14
HB-20-EZ-CLEAN	50	8	7

Carton dimensions: 10"x10"x21" (for both 10" and 20")

M5-4 20 Micron Filter (HBB-20-20W)

This material was purchased from a Harmsco Distributer. Product information can be seen below.



Harmsco® Calypso Blue™ Cartridges To Fit 4-1/2" Diameter Filter Housings

Premium quality cartridges made of pleated polyester filter media for long life and high dirt holding capacity. Cartridges can be cleaned and reused in most applications and micron ratings. Available for both 10" and 20" Big-Blue® housings. Individually shrink wrapped.

NSF

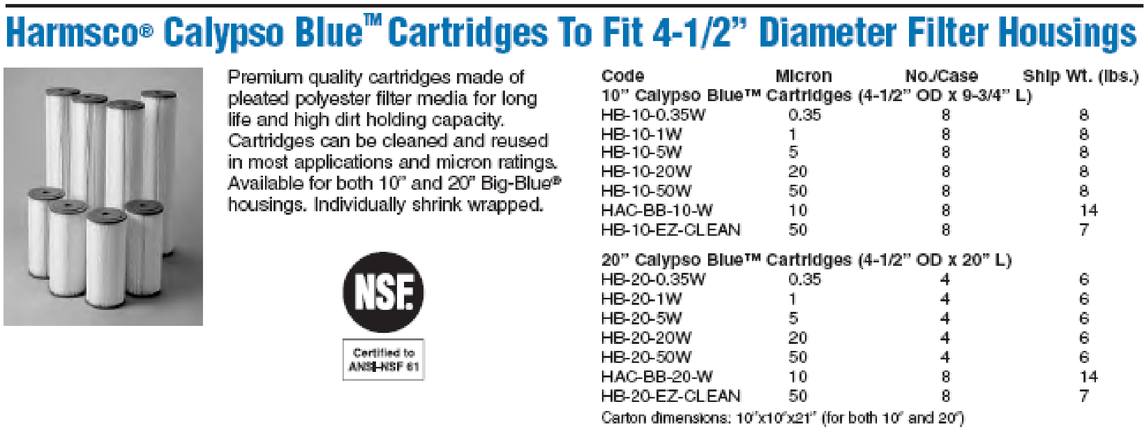
Certified to ANSI-NSF 61

Code	Micron	No./Case	Ship Wt. (lbs.)
10" Calypso Blue™ Cartridges (4-1/2" OD x 9-3/4" L)			
HB-10-0.35W	0.35	8	8
HB-10-1W	1	8	8
HB-10-5W	5	8	8
HB-10-20W	20	8	8
HB-10-50W	50	8	8
HAC-BB-10-W	10	8	14
HB-10-EZ-CLEAN	50	8	7
20" Calypso Blue™ Cartridges (4-1/2" OD x 20" L)			
HB-20-0.35W	0.35	4	6
HB-20-1W	1	4	6
HB-20-5W	5	4	6
HB-20-20W	20	4	6
HB-20-50W	50	4	6
HAC-BB-20-W	10	8	14
HB-20-EZ-CLEAN	50	8	7

Carton dimensions: 10"x10"x21" (for both 10" and 20")

M5-5 Carbon Filter (HAC-BB-20-W)

This material was purchased from a Harmsco Distributer. Product information can be seen below.



Harmsco® Calypso Blue™ Cartridges To Fit 4-1/2" Diameter Filter Housings

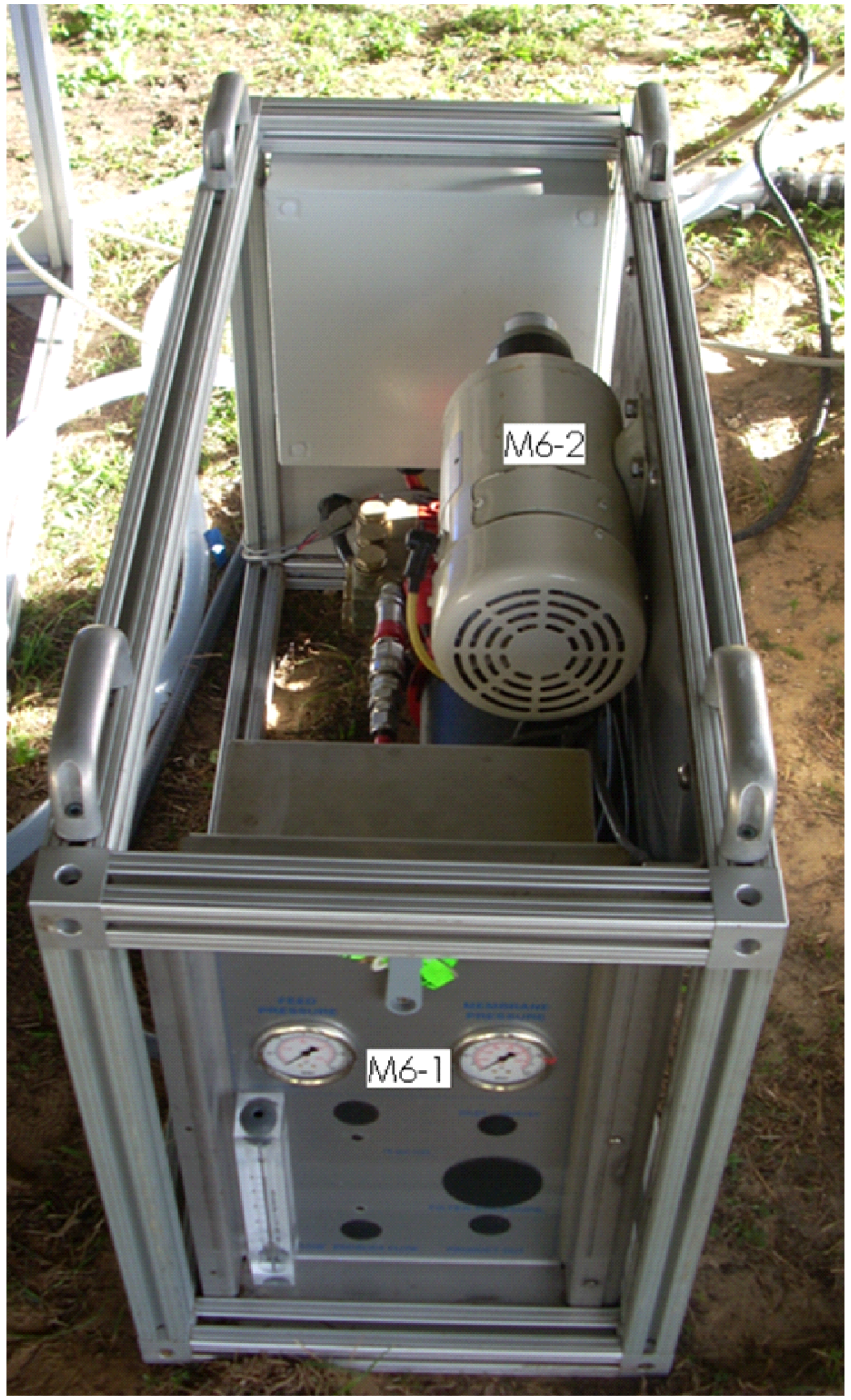
Premium quality cartridges made of pleated polyester filter media for long life and high dirt holding capacity. Cartridges can be cleaned and reused in most applications and micron ratings. Available for both 10" and 20" Big-Blue® housings. Individually shrink wrapped.

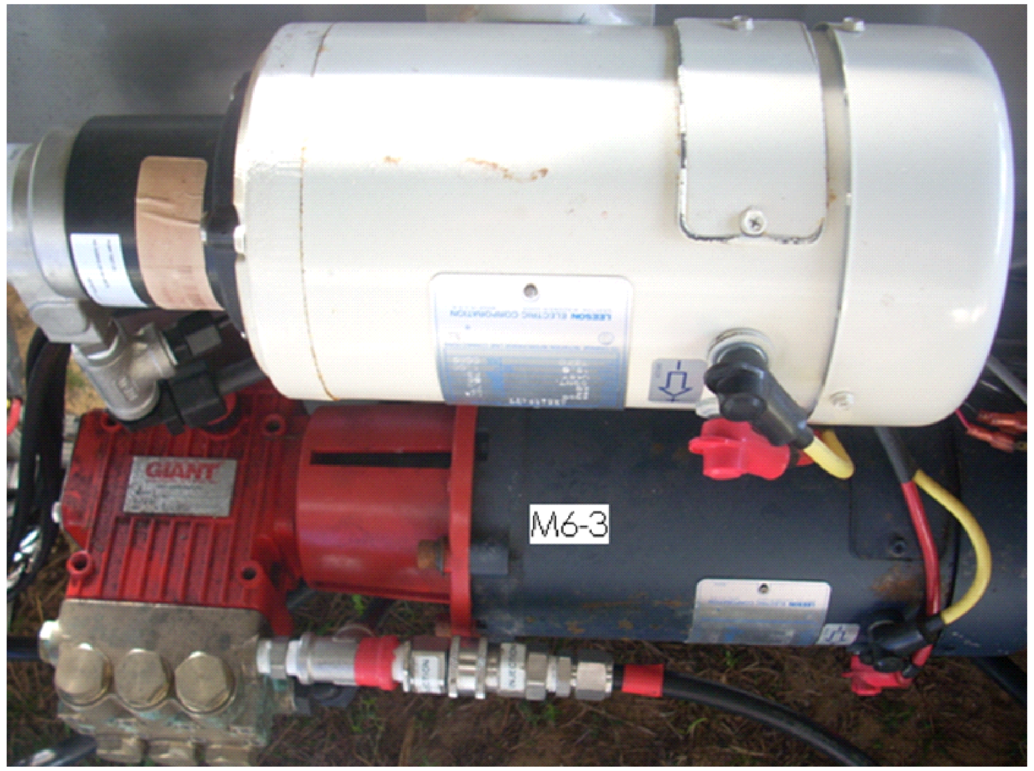
NSF

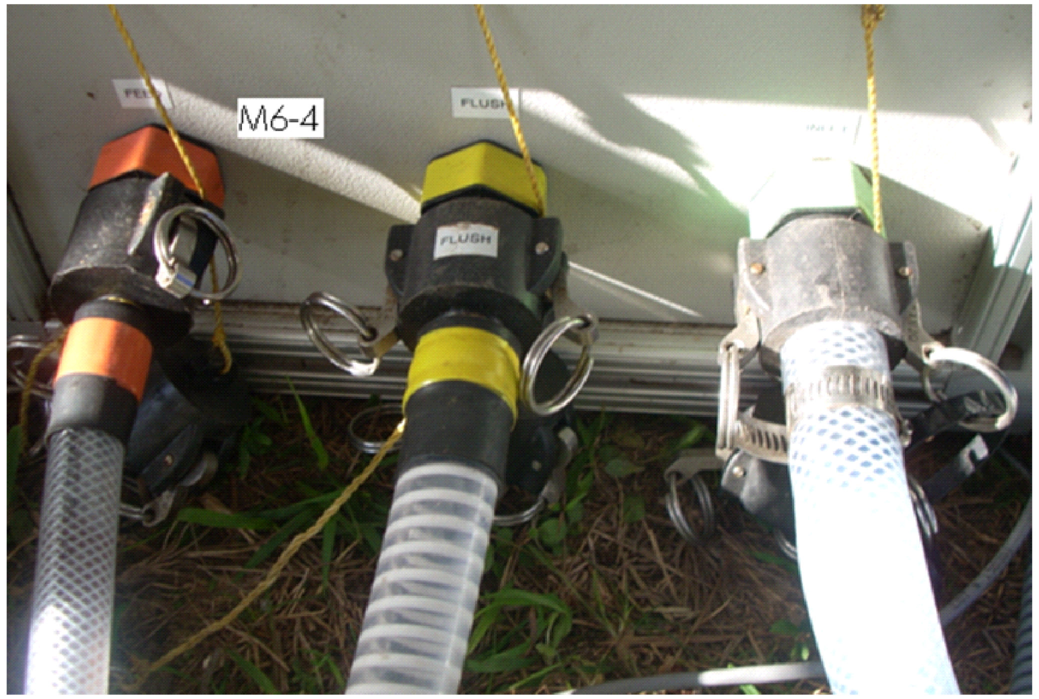
Certified to ANSI-NSF 61

Code	Micron	No./Case	Ship Wt. (lbs.)
10" Calypso Blue™ Cartridges (4-1/2" OD x 9-3/4" L)			
HB-10-0.35W	0.35	8	8
HB-10-1W	1	8	8
HB-10-5W	5	8	8
HB-10-20W	20	8	8
HB-10-50W	50	8	8
HAC-BB-10-W	10	8	14
HB-10-EZ-CLEAN	50	8	7
20" Calypso Blue™ Cartridges (4-1/2" OD x 20" L)			
HB-20-0.35W	0.35	4	6
HB-20-1W	1	4	6
HB-20-5W	5	4	6
HB-20-20W	20	4	6
HB-20-50W	50	4	6
HAC-BB-20-W	10	8	14
HB-20-EZ-CLEAN	50	8	7

Carton dimensions: 10"x10"x21" (for both 10" and 20")







ITEM NO.	QTY.	DESCRIPTION
M6-1	1	CONTROL PANEL
M6-2	1	VANE PUMP
M6-3	1	INJECTION PUMP
M6-4	1	HOSE INLETS/OUTLETS

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COMMENTS:
DIMENSIONS ARE IN INCHES

MORE DETAILED COMPONENT INFORMATION IS AVAILABLE IN THE APPENDICES

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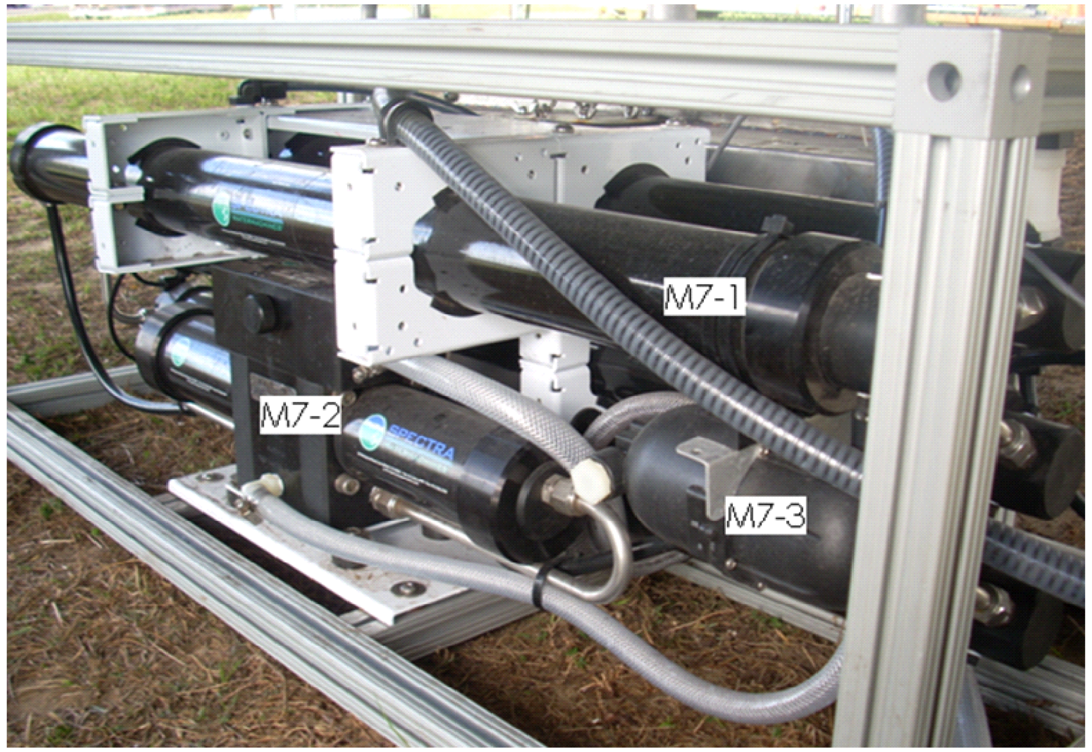
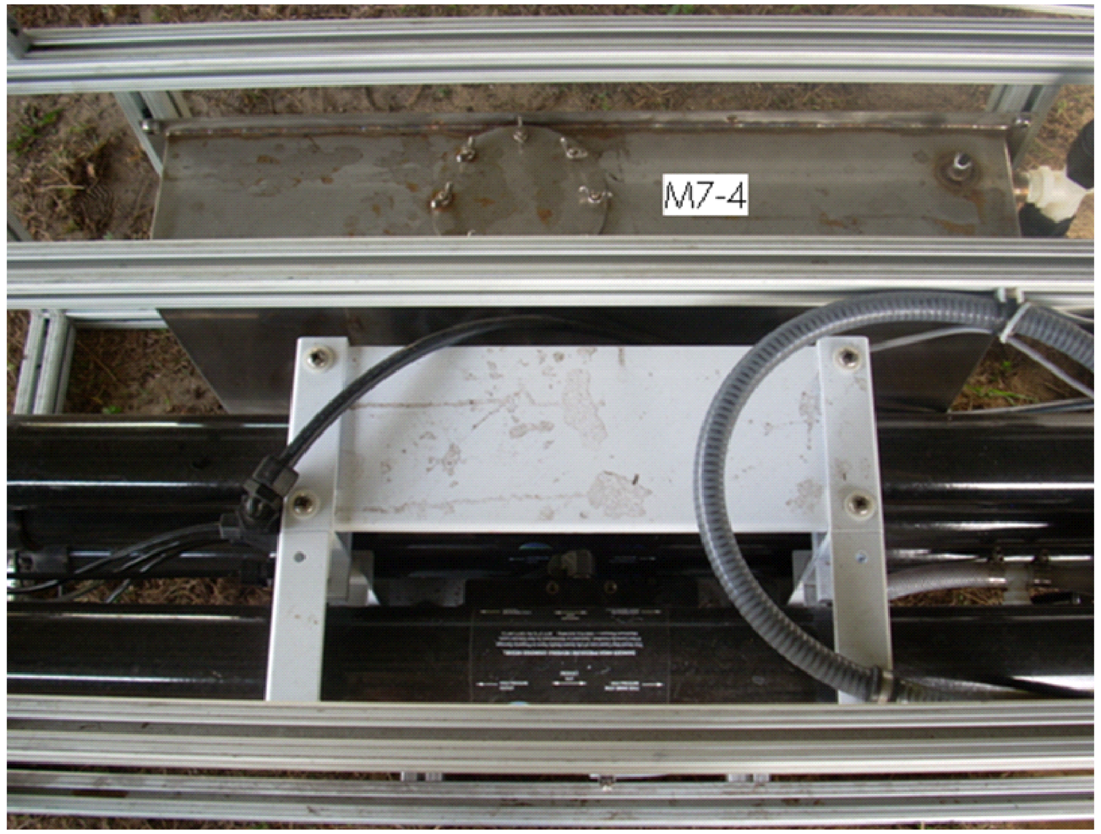
TITLE:
HIGH PRESSURE
PUMP MODULE

SIZE **B**
DWG. NO. M6
REV
SCALE: NTS
SHEET 6 OF 7





ITEM NO.	QTY.	DESCRIPTION
M7-1	4	REVERSE OSMOSIS MEMBRANES
M7-2	1	CLARK PUMP
M7-3	1	PRESSURE DAMPENER
M7-4	1	FLUSH TANK

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TITLE:
REVERSE OSMOSIS MODULE

SIZE	DWG. NO.	REV
B	M7	
SCALE: NTS		SHEET 7 OF 7